Vol. II

TRANSCRIPT OF RECORD

Supreme Court of the United States

OCTOBER TERM, 1943

No. 58

THE MERCOID CORPORATION, PETITIONER,

vs.

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

No. 59

THE MERCOID CORPORATION, PETITIONER,

vs.

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

ON WRITS OF CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE SEVENTH CIRCUIT

PETITION FOR CERTIORARI FILED MAY 3, 1943.

CERTIORARI GRANTED JUNE 7, 1943.

VOL. II pp. 657 to 1241.

TRANSCRIPT OF RECORD

IN THE

Supreme Court of the United States

October Term, A. D. 1942.

No.

THE MERCOID CORPORATION,

Petitioner,

vs.

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY,

Respondent.

ON WRIT OF CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE SEVENTH CIRCUIT.

THE GUNTHORP-WARREN PRINTING COMPANY, 210 WEST JACKSON, CHICAGO

IN THE

Supreme Court of the United States

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Respondent.

ON WRIT OF CERTIORARI TO THE UNITED STATES CIRIUIT COURT OF APPEALS FOR THE SEVENTH CIRCUIT.

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TRANSCRIPT OF RECORD.

IN THE

UNITED STATES CIRCUIT COURT OF APPEALS

FOR THE SEVENTH CIRCUIT.

No. 8019.

THE MERCOID CORPORATION,
Plaintiff-Appellee,

vs.

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY,
Defendant-Appellant.

No. 8020.

THE MERCOID CORPORATION,
Plaintiff-Appellant,

vs.

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY,
Defendant-Appellee.

Appeals from the District Court of the United States for the Northern District of Illinois, Eastern Division.

TRANSCRIPT OF RECORD FILED MAY 23, 1942.

~~PRINTED RECORD.~~

U S C C A
FILED
JUL 13 1942

IN THE

UNITED STATES CIRCUIT COURT OF APPEALS

FOR THE SEVENTH CIRCUIT.

No. 8019.

THE MERCOID CORPORATION,

Plaintiff-Appellee,

vs.

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY,

Defendant-Appellant.

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Appeals from the District Court of the United States for the Northern District of Illinois, Eastern Division.

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DEFENDANT'S EXHIBITS.

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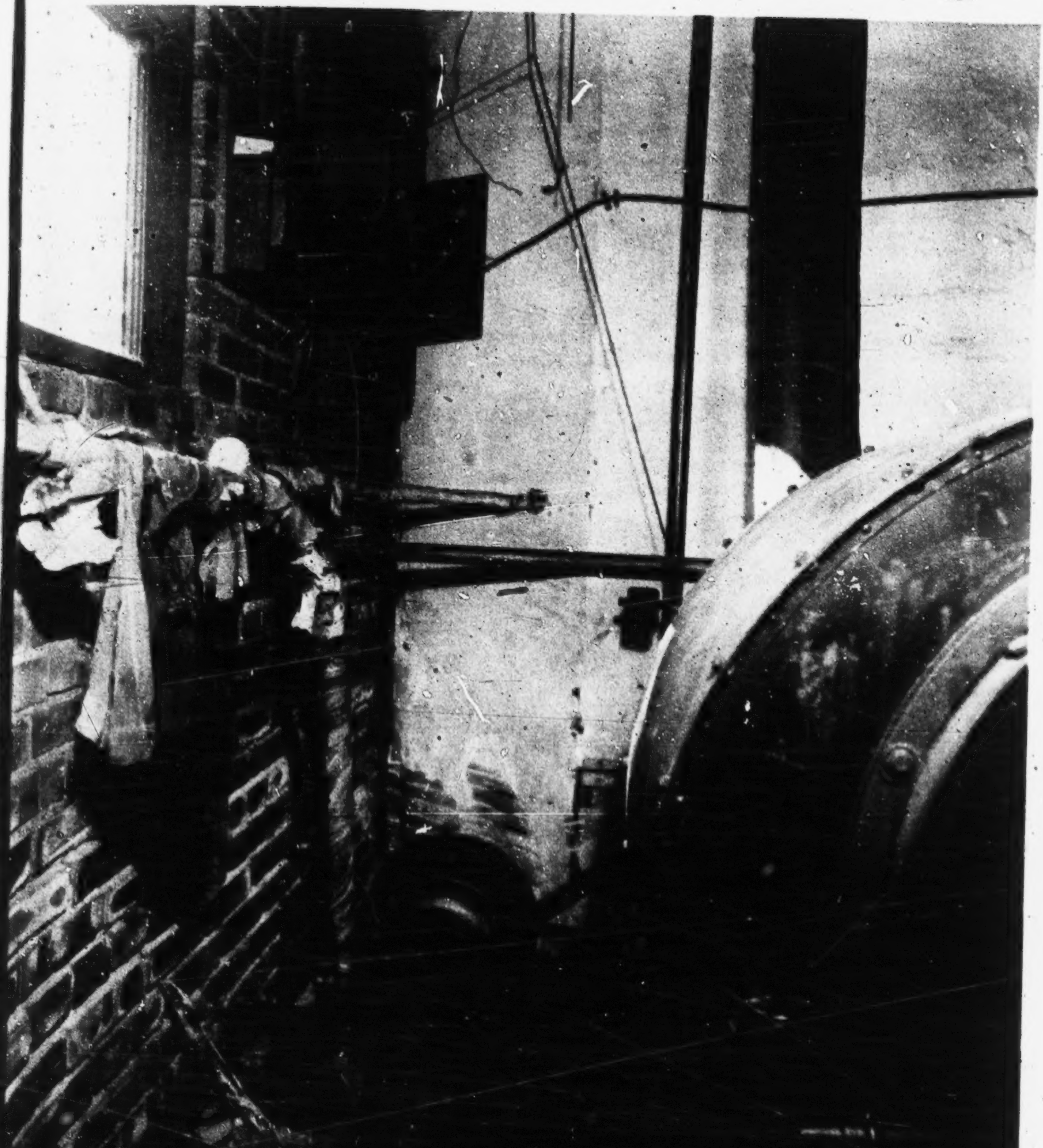
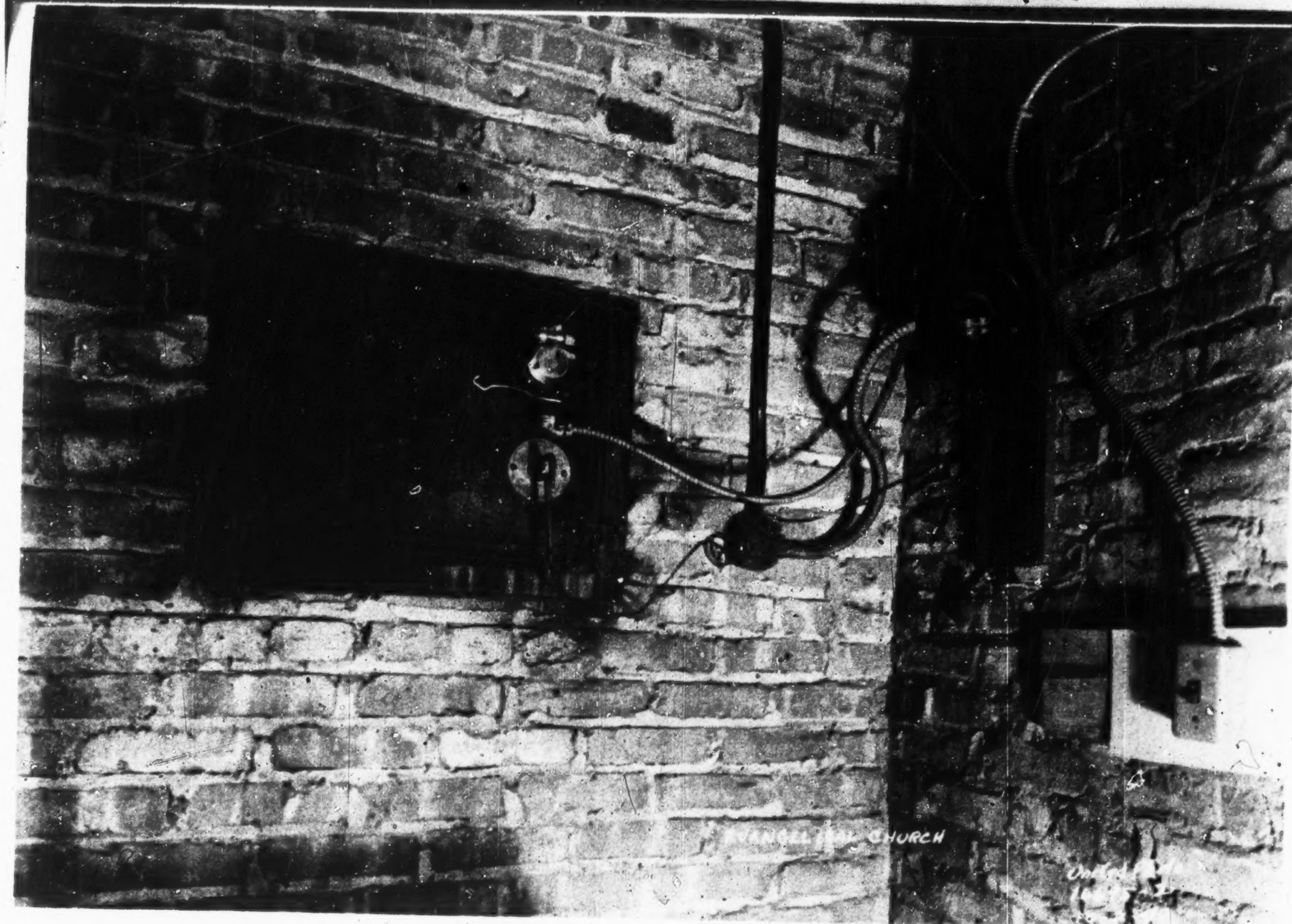
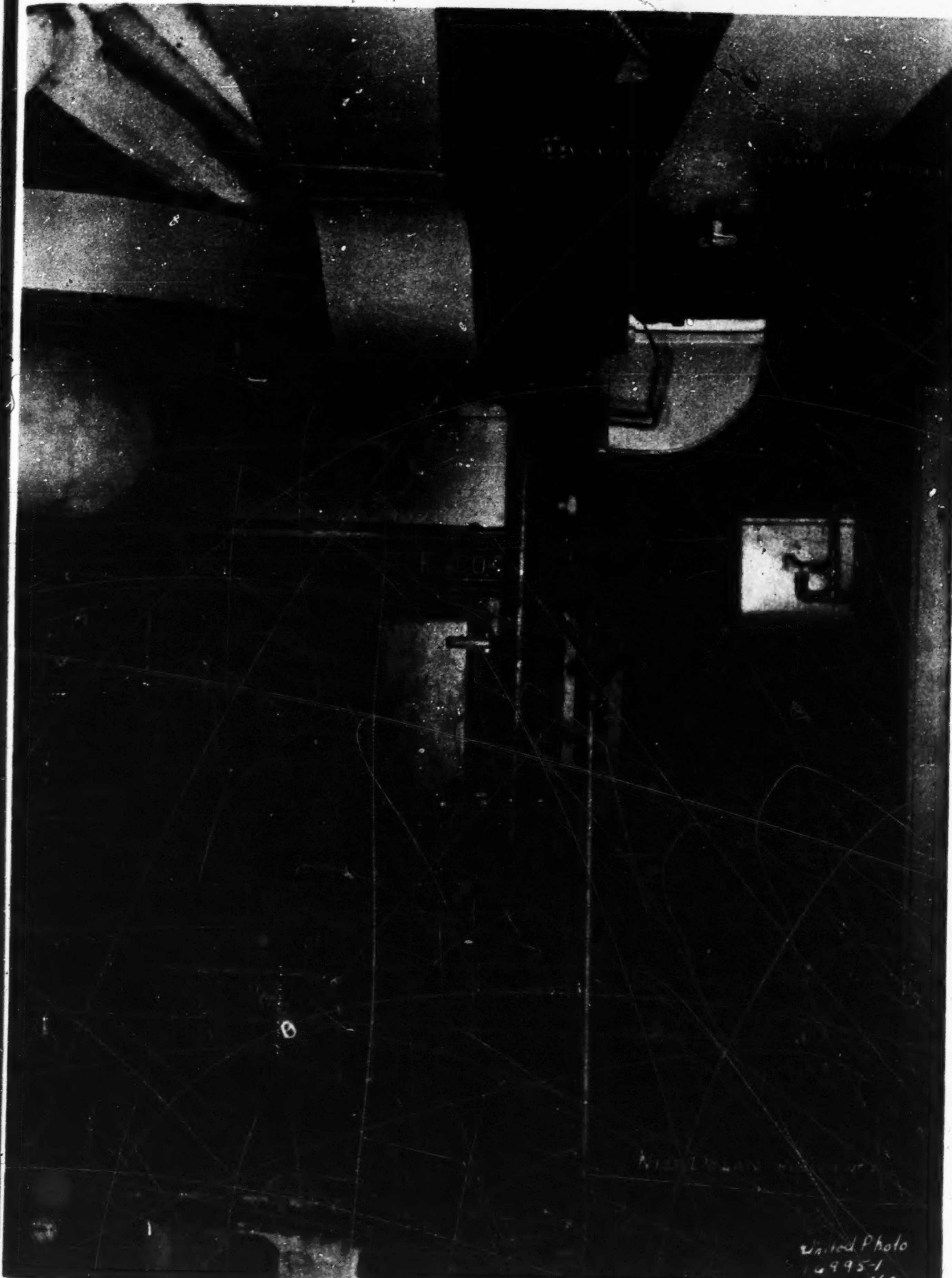


MERCOID EXHIBIT A-2



MERCOID EXHIBIT A-3

MERCOID EXHIBIT A-4



MERCOID EXHIBIT B-1

MERCOID EXHIBIT B-2

WILLIAMS OIL-O-MA... CORPORATION
Customer's Invoice Duplicate—Accounting Dept. Copy

Shipping Order No. 2175

Invoice No. 2051

Filled by ... CK'd by ...

Marks 3-3313

B/L Attached

Date Billed ... Bill Clk.

Due JUL 10 1926

SHIPPING DATE

F. O. B.

VIA

CREDIT APPROVED

DATE

BY ... Credit Man.

BACK ORDER No.

... FRONT STREET,
CITY

ITEM DESCRIPTION	PRICE	AMOUNT
...MATIC 1200 PRIM	322	
... CONTROL	153	
...TCH & SAFETY		
...MOSTAT	475 00	
...-GALLON TANK ~~DEPOSIT~~	~~50 00~~	
	~~425 00~~	
... MODEL G		
... INSTALLED AT ONCE		

2
Shipping Weights ... Net Totals

Tare ... Net ... Net Sales

MERCOID EXHIBIT C-1

WILLIAMS OIL-O-MATIC HEATING CORPORATION
BLOOMINGTON, ILLINOIS

No. 10669 P.

Invoice No.

Filled by O. K'd by

Marks

B-L Attached

SHIPPING DATE

F. O. B.

VIA

BACK ORDER No.

...elical Freidens Church

Quantities			Terms	Price	Amount
1	1		Federal Mercoid Thermostat		36.00
1	1		Federal Mercoid Furnace Control		36.00
1	1		Special Federal Mercoid Control		46.00
1	1		Allen-Bradley Relay Switch 110 60 Cycle 3 H.P.		31.00
					149.00

INVOICE DUPLICATE

Shipping Weight

GROSS TARE NET

MERCOID EXHIBIT C-2

2/22/30

223673
31068

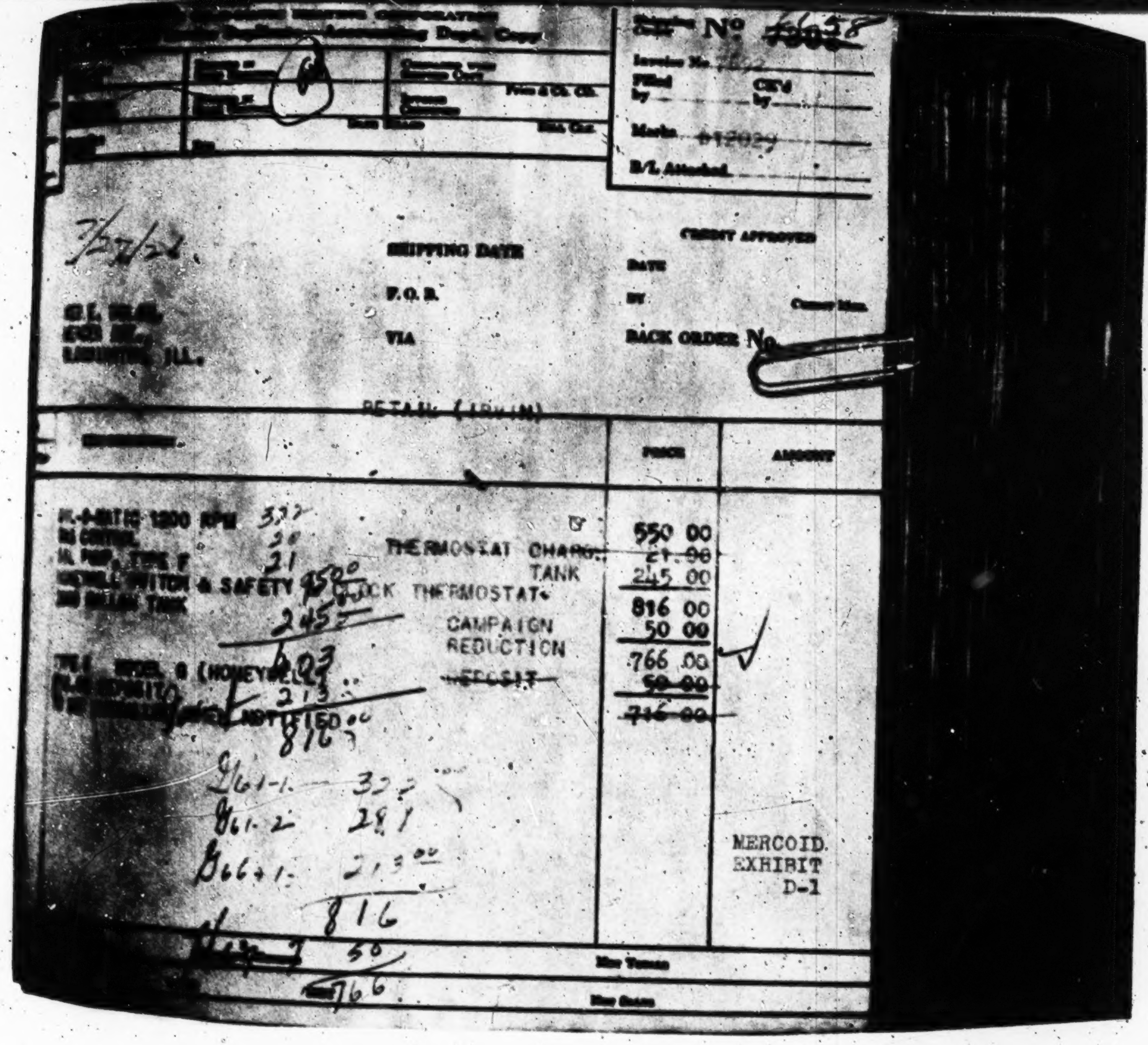
TED
1930

EVANGELICAL CHURCH
502 W. FRONT ST.
CITY.

CHARGE FOR REPLACING XXXXXXXXX MERCOID
FURNACE CONTROL FOR FURNACE FAN

14 75

MERCOID EXHIBIT C-3



Shipping Order No. ~~#5058~~ 6658

Invoice No.

Filed by — Ck'd by

Marks #12029

B/L Attached

7/27/28

SHIPPING DATE

F.O.B.

VIA

CREDIT APPROVED

DATE

BY

BACK ORDER No.

ILL.

RETAIL (IRWIN)

	PRICE	AMOUNT
1200 RPM 332	550 00	
30 THERMOSTAT CHARGE	~~21 00~~	
21 TANK	245 00	
SAFETY 550.00 CLOCK THERMOSTAT 245	816 00	
CAMPAIGN REDUCTION	50 00	
6.03 (HONEYWELL) 213	766 00	
~~DEPOSIT~~	~~50 00~~	
NOTIFIED 816.00	~~716 00~~	

G61-1 — 332

G61-2 — 281

G66+1 — 213.00

816

50

766

MERCOID
EXHIBIT
D-1

WILLIAMS OIL-O-MATIC HEATING CORPORATION

Customer's Invoice Duplicate—Accounting Dept. Copy

10847

4/11/[illegible]

SHIPPED TO

SOLD TO

ADDRESS

[illegible]
[illegible] AVE.,
[illegible]TON, ILL.

QUANTITIES	ITEM DESCRIPTION	PRICE	AMOUNT
1	75 VOLT HONEYWELL SAFETY		5.00
	MATERIAL USED TO REBRICK FURNACE:		
	20 #3 ARCH BRICK @ .08		1.60
	40 STANDARD BRICK .08		[illegible]
	6 HOURS LABOR 1.50		[illegible]
	CEMENT		[illegible]
			[illegible]

565

QUANTITIES VERIFIED WITH SHIPPER'S COPY

COLLECTION MEMORANDUM

SHIPPING WEIGHTS

DATE

BILL CLERK

GROSS

TARE

NET

MERCOID EXHIBIT D-2

WILLIAMS OIL-O-MATIC HEATING CORPORATION

NAME : NED E. DOLAN
MERCE[illegible] AVE.

ADDRESS CITY

SHEET NO.

LIMIT

DATE 1926	ITEM	DEBITS	CREDITS	NEW BALANCE	OLD BALANCE
JUNE 1	DEP		50 00	50 00	50 00
JULY 27	INV. 769[illegible]	766 00		71[illegible] 00	

[illegible] EXHIBIT [illegible]

WILLIAMS OIL-O-MATIC HEATING CORPORATION

NAME EVANGELICAL FRIEDENS CHURCH

ADDRESS FRED HEISE, TREAS.

SHEET No.

DATE	ITEM	DEBITS	CREDITS	NEW BALANCE	OLD BALANCE
1925 MAY 25	DEPOSIT		50 00CR	50 00	50 00
JULY 18	OIL O MATIC	475 00		425 00	425 00
NOV 30	CASH		425 00	00	
1926 FEB 3	INV.5941	35 00		35 00	35 00
MAR [illegible]	C/M77[illegible]		35 00	00	
JULY 7		35 00		35 00	

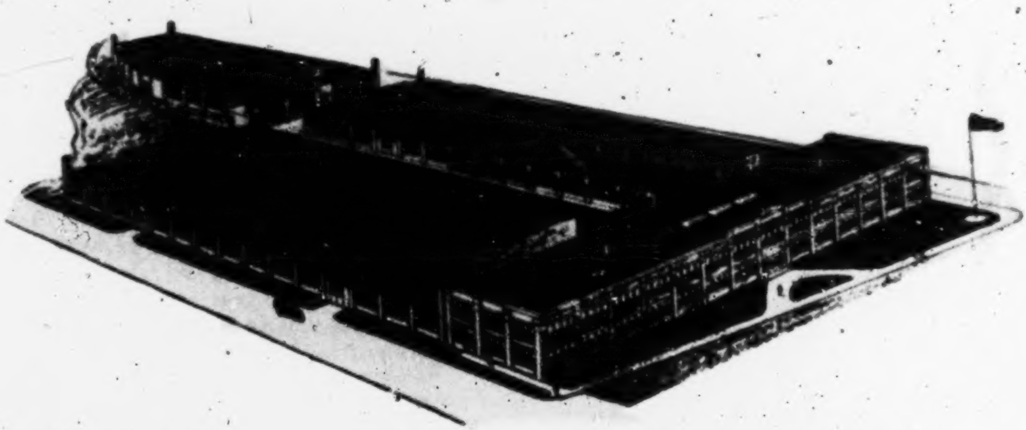
MERCOID EXHIBIT D-4

681

INSTALLATION
and
SERVICE MANUAL

Revised Edition to Include Model "J" Oil-O-Matic

WILLIAMS OIL-O-MATIC HEATING



"World's Largest Producers of Automatic Oil Burners"

Line drawing from an actual photograph of the Home-Office and Factory of the Williams Oil-O-Matic Heating Corporation, Bloomington, Illinois. Airplane Photo was taken from a height of 800 feet.

MERCOID EXHIBIT E-2

DEALERS INSTALLATION AND SERVICE MANUAL

Installations illustrated protected by patents and patents pending.

GENERAL ALPHABETICAL INDEX

IMPORTANT - See Sheets No. A-236.

BRICKING

NOTE:

End of draft pipe must be 1/2" back from inside face of fire pot wall.

DEALERS INSTALLATION AND SERVICE MANUAL

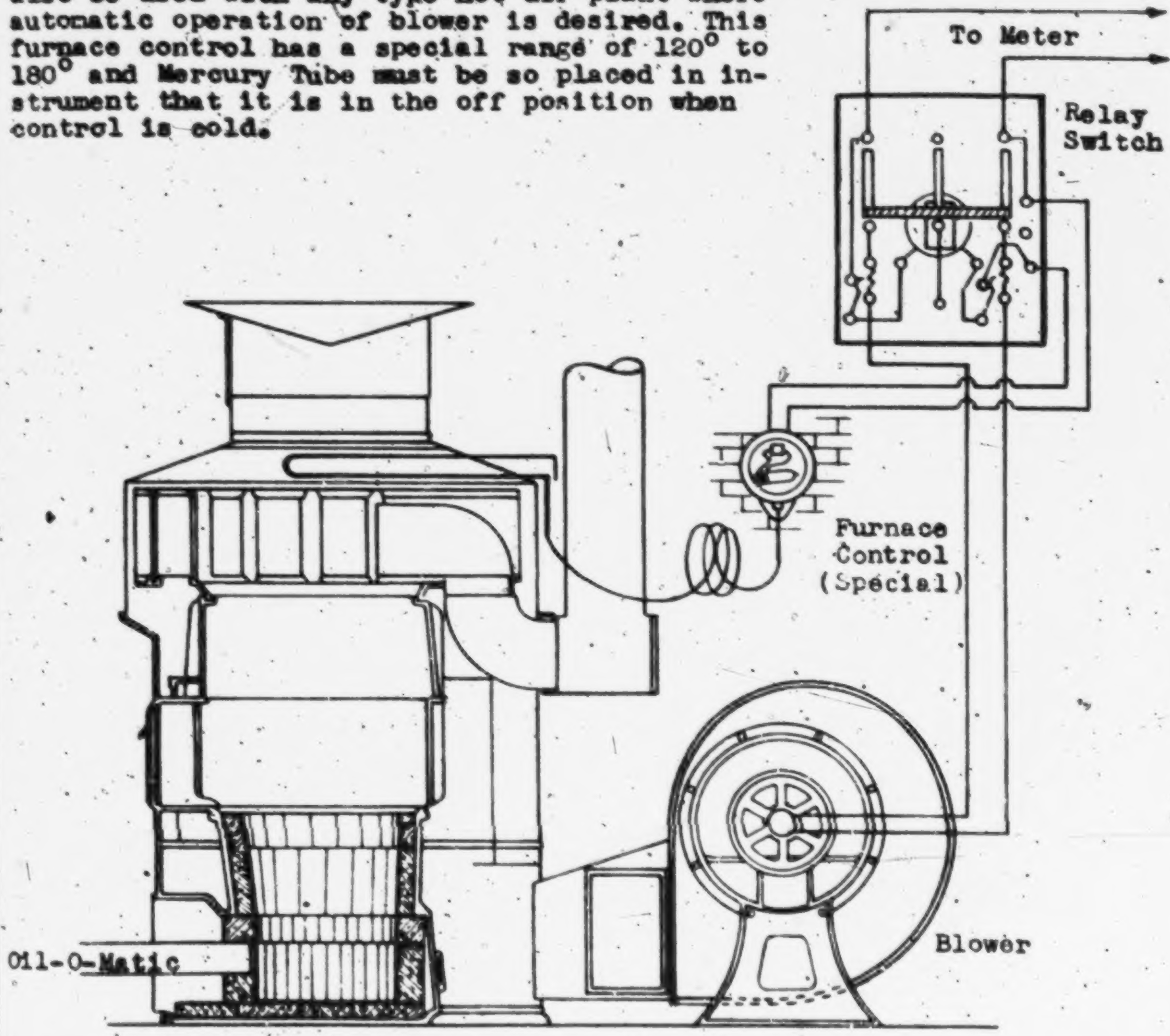
Installations illustrated protected by patents and patents pending.

GENERAL ALPHABETICAL INDEX

WIRING

WIRING FOR MODEL "J"

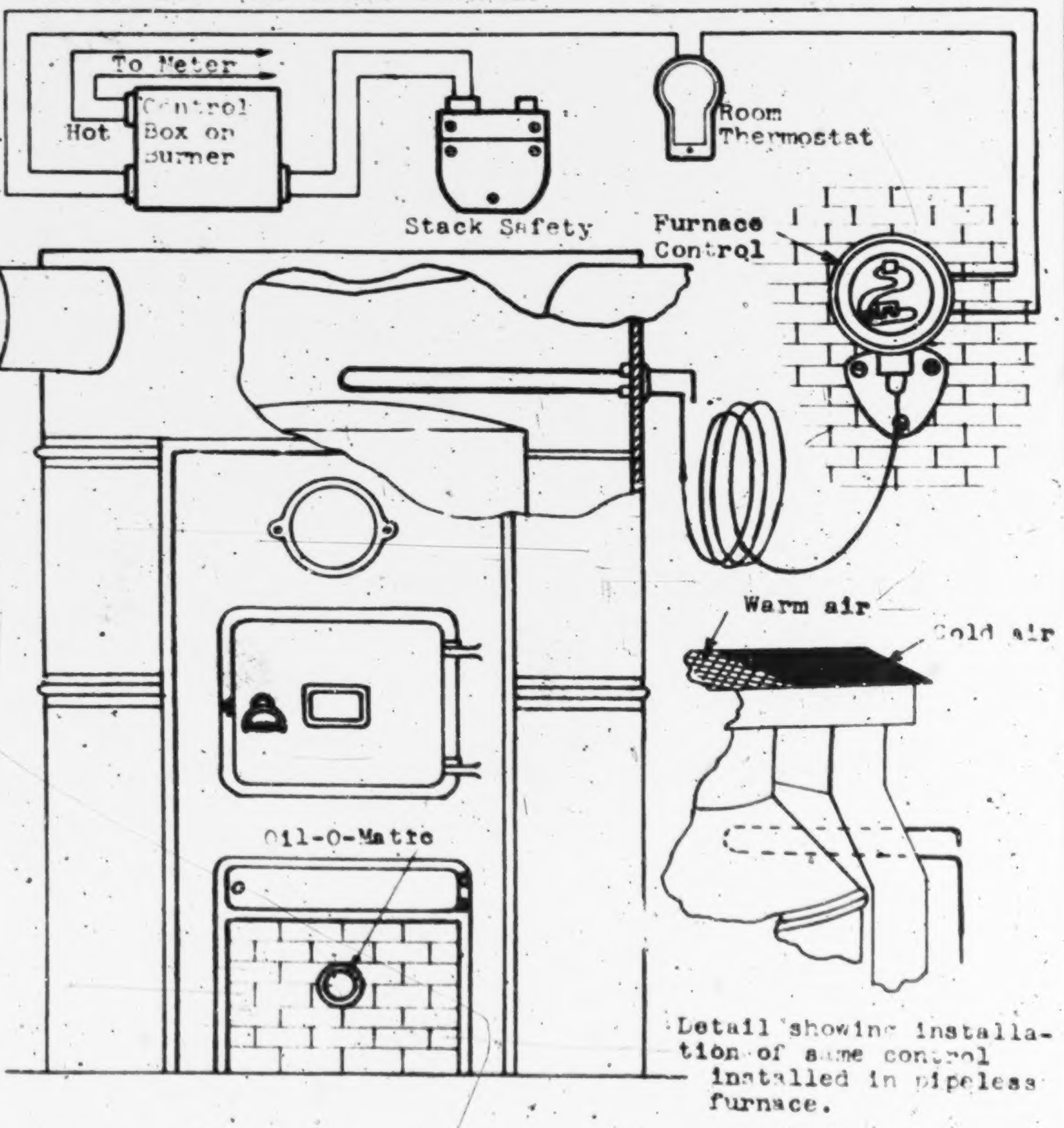
Bricking Diagram showing Blower Type American Direct Fired Unit Heater using Allen Bradley Type J-1552-Form "T" Starting Switch with Mercury Special Hot Air Furnace Control for pilot to start blower automatically at 180° and to stop at 120° furnace temperature. This plan of operation can also be used with any type hot air plant where automatic operation of blower is desired. This furnace control has a special range of 120° to 180° and Mercury Tube must be so placed in instrument that it is in the off position when control is cold.



TYPICAL CROSS SECTION OF FIRE POT

DRAWN BY H.V.G.	WILLIAMS OIL-O-MATIC HEATING CORPORATION BLOOMINGTON, ILLINOIS	DATE Oct. 19-26
APPROVED O.H.P.		SHEET NO A 67

DIAGRAM SHOWING THE INSTALLATION OF A MERCOID FURNACE CONTROL FOR WARM AIR FURNACES.
Standard Range 250° to 300° F. Range may be adjusted by sliding loaded stem in or out of furnace hood above furnace dome, or by standard adjustment on back. For automatic control on warm air furnace, it acts as safety device to prevent overheating of furnace. Control must be installed above the top of the inside dome. This control operates on the same principle as the Federal Mercoid Hot Water Boiler Control.

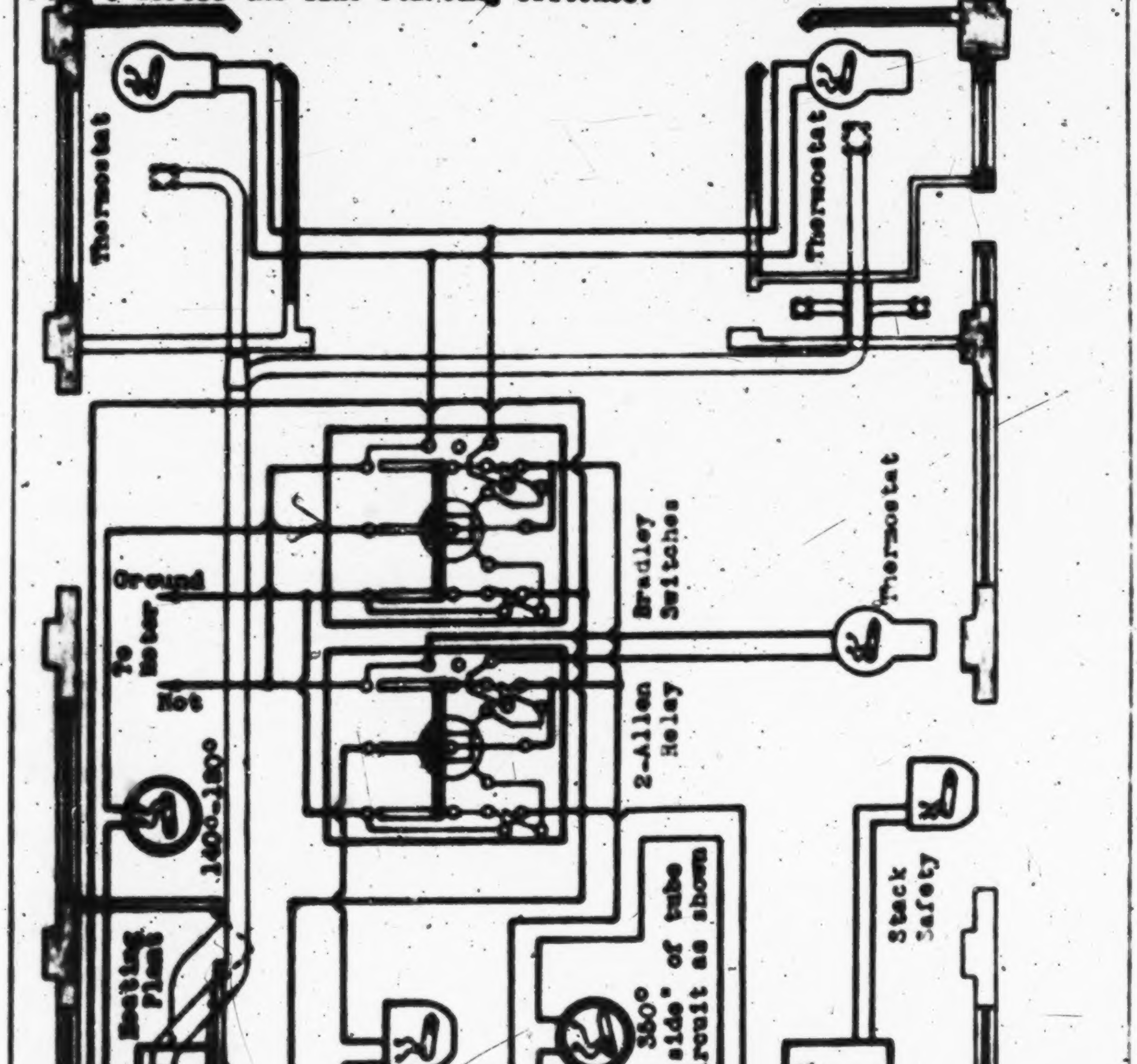


Detail showing installation of same control installed in pipeless furnace.

Drawn By H.L.G. Approved By OAP	WILLIAMS OIL-O-MATIC HEATING CORPORATION BLOOMINGTON, ILLINOIS	Date DEC. 24, '25. Sheet No A 150

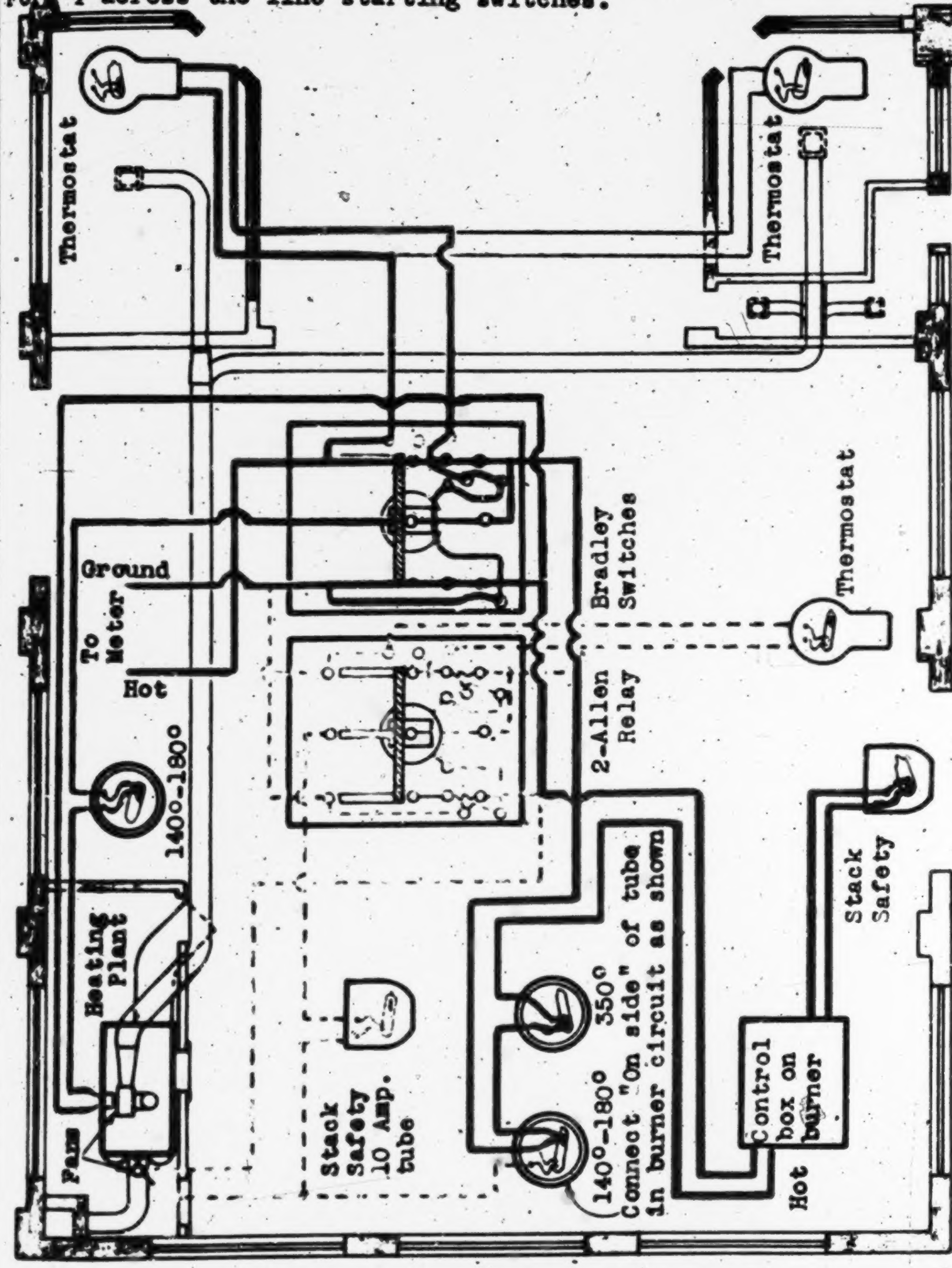
PRINTED IN U.S.A.

Fan type direct fired heating system showing wiring diagram with Oil-O-Matic Burner. Controls necessary for installation as shown consist of: Three standard Mercoid Thermostats. One Honeywell Stack Safety with ten amper tube. One Mercoid Hot Air Control range 140°to 180° F with ten amper tube and contact off in cold position. One Mercoid Hot Air Furnace Control range 140°to 180° F with three circuit tube. One standard Mercoid Furnace Temperature Control 350°. Two Allen-Bradley Type J-155 Form T across the line starting switches.



MERCOID EXHIBIT F-1

Fan type direct fired heating system showing wiring diagram with Oil-O-Matic Burner. Controls necessary for installation as shown consist of: Three standard Mercoid Thermostats. One Honeywell Stack Safety with ten amper tube. One Mercoid Hot Air Control range 140° to 180° F with ten amper tube and contact off in cold position. One Mercoid Hot Air Furnace Control range 140° to 180° F with three circuit tube. One standard Mercoid Furnace Temperature Control 350°. Two Allen-Bradley Type J-155 Form T across the line starting switches.

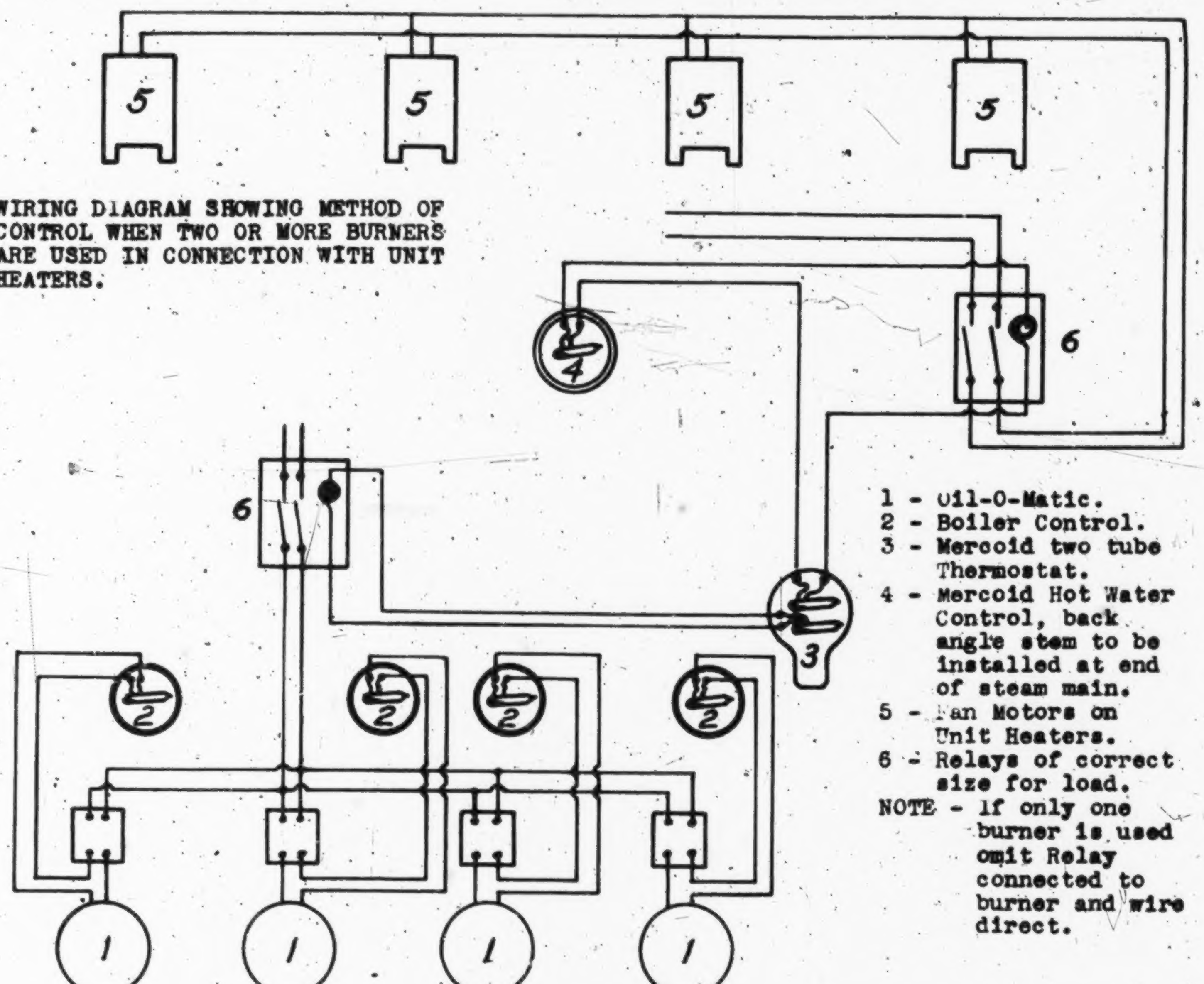


DRAWN BY H.V.G. | WILLIAMS OIL-O-MATIC HEATING CORPORATION BLOOMINGTON, ILLINOIS | DATE May 5-27

APPROVED BY O.H.P. | SHEET NO. A 198

ES-10-4-5-27 | PRINTED IN U.S.A.

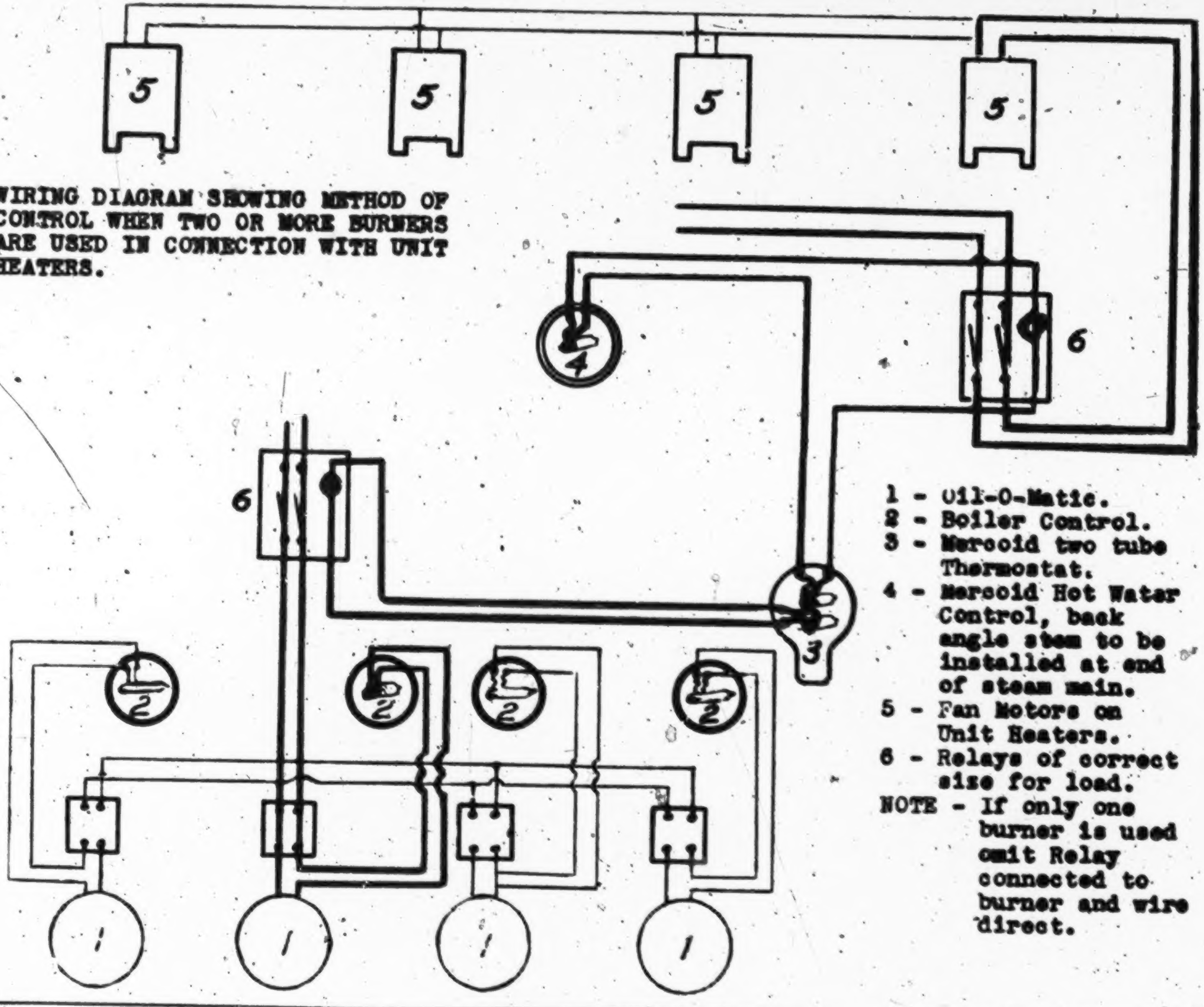
MERCOID EXHIBIT F-3.



WIRING DIAGRAM SHOWING METHOD OF CONTROL WHEN TWO OR MORE BURNERS ARE USED IN CONNECTION WITH UNIT HEATERS.

DRAWN BY EHS	WILLIAMS OIL-O-MATIC HEATING CORPORATION BLOOMINGTON, ILLINOIS	MERCOID EXHIBIT G-1
APPROVED BY		DATE 6-14-30
		SHEET NO. JA-258

WIRING DIAGRAM SHOWING METHOD OF CONTROL WHEN TWO OR MORE BURNERS ARE USED IN CONNECTION WITH UNIT HEATERS.



1 - Oil-O-Matic.
2 - Boiler Control.
3 - Mercoid two tube Thermostat.
4 - Mercoid Hot Water Control, back angle stem to be installed at end of steam main.
5 - Fan Motors on Unit Heaters.
6 - Relays of correct size for load.

NOTE - If only one burner is used omit Relay connected to burner and wire direct.

Drawn By EHS

Approved By

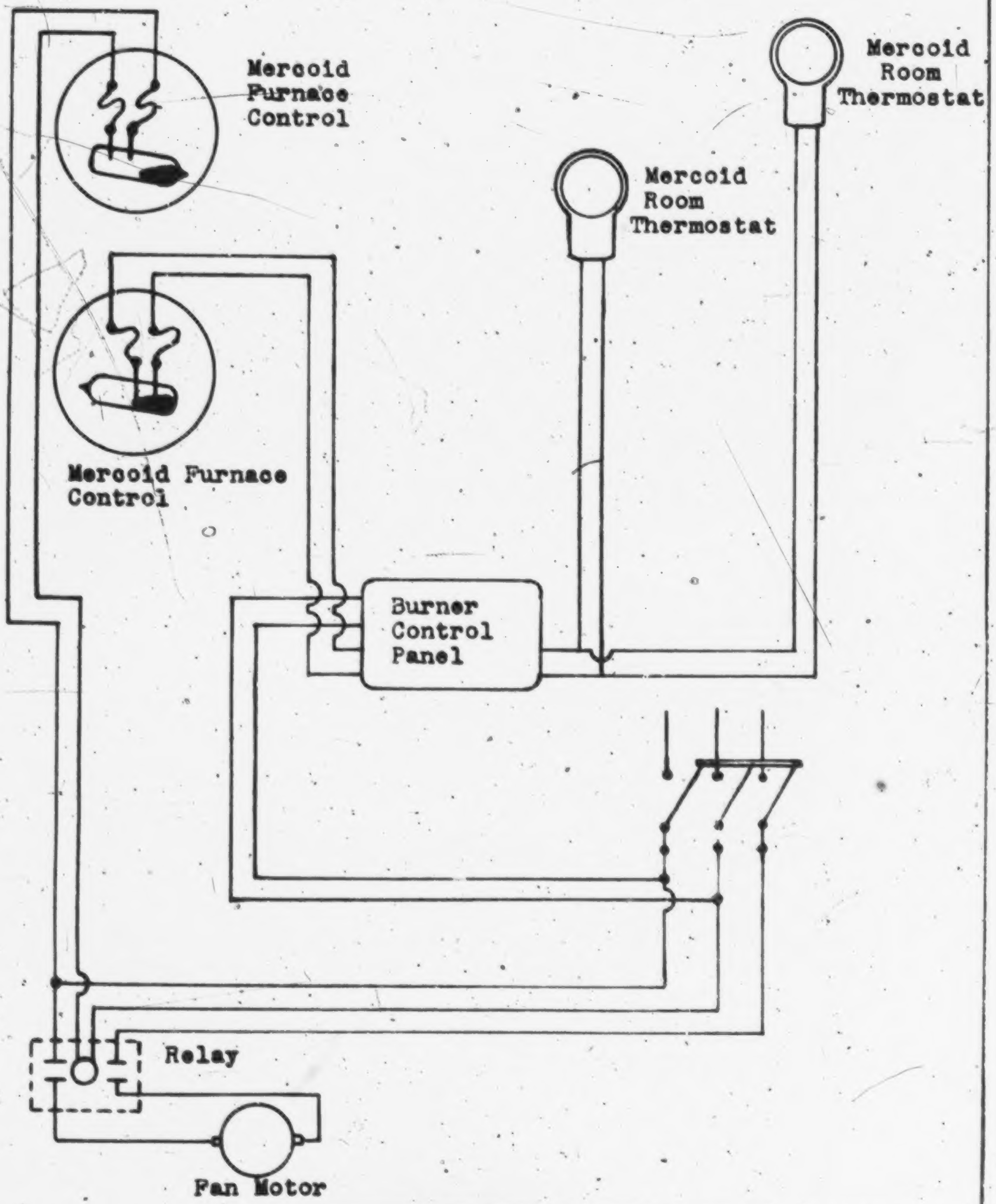
WILLIAMS OIL-O-MATIC HEATING CORPORATION BLOOMINGTON, ILLINOIS

MERCOID EXHIBIT G-4

Date 6-14-30

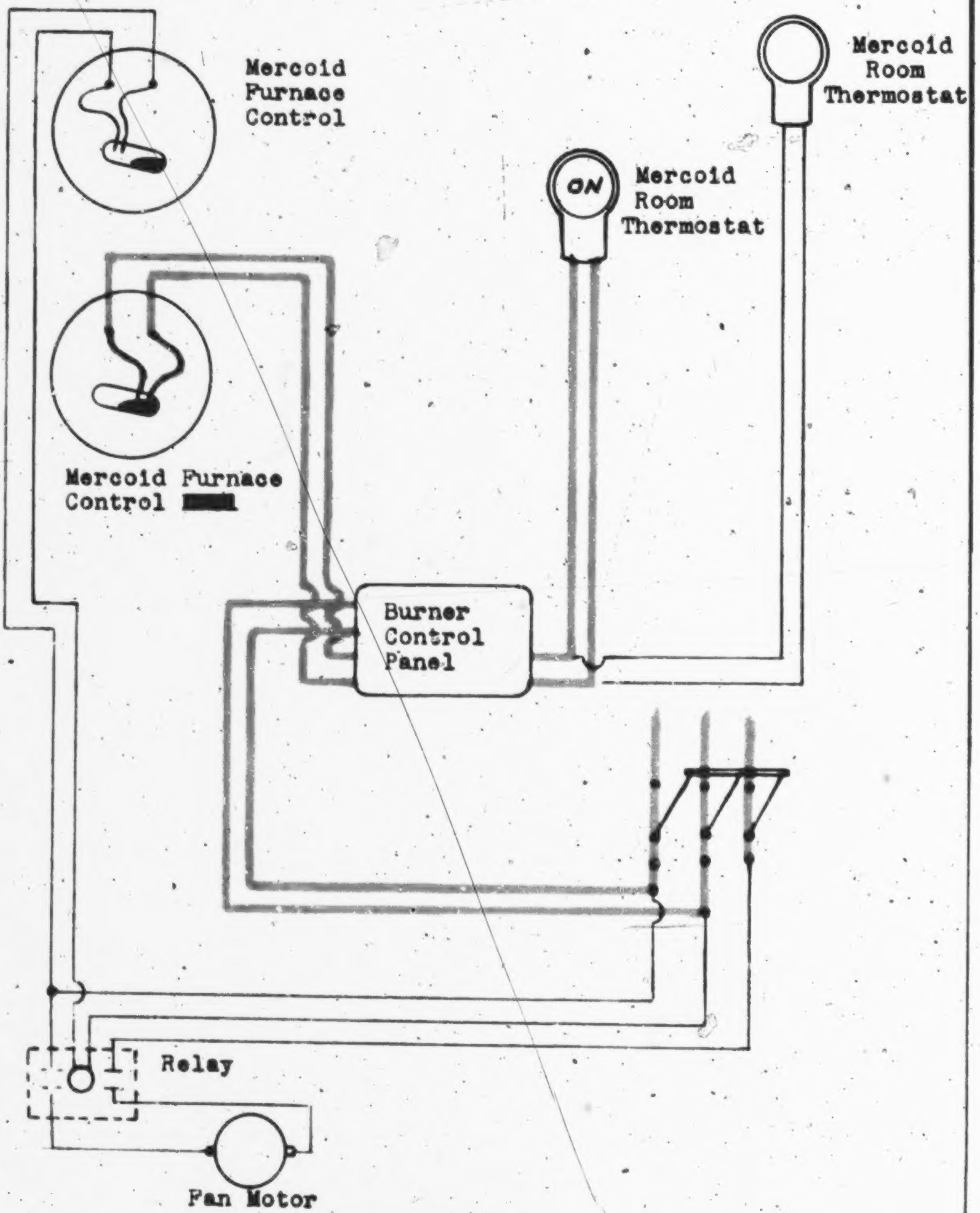
Sheet No. JA-258

WIRING DIAGRAM OF INSTALLATION IN EVANGELICAL CHURCH, LEE AND FRONT STREET, BLOOMINGTON, ILLINOIS WHEN INSPECTED OCTOBER 2, 1940



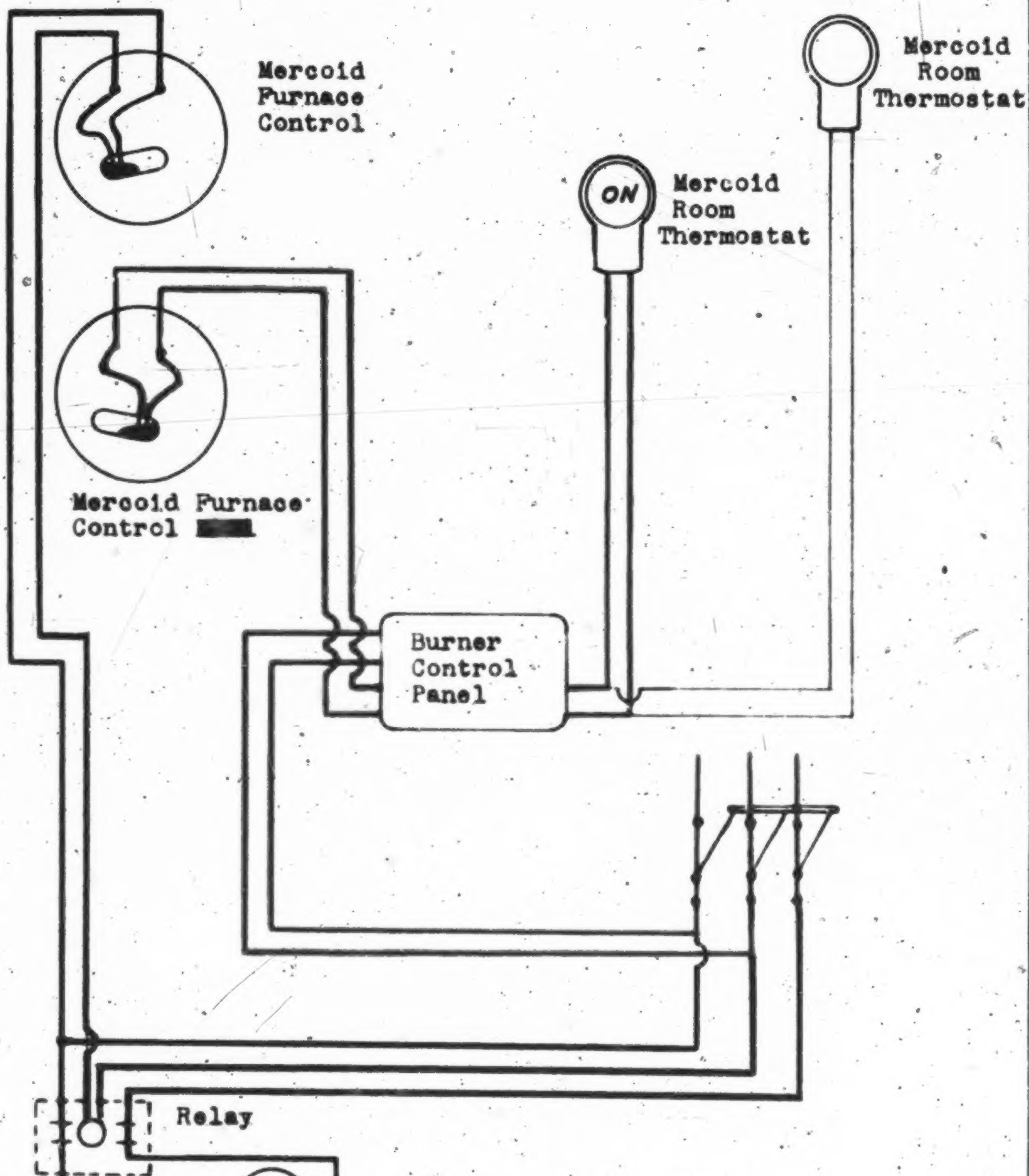
Drawn By H.V.G.	WILLIAMS OIL-O-MATIC HEATING CORPORATION BLOOMINGTON, ILLINOIS	MERCOID EXHIBIT H-1
Approved By R.H.P.		Date Oct. 2, 1940
		Sheet No.

WIRING DIAGRAM OF INSTALLATION IN EVANGELICAL CHURCH, LEE AND FRONT STREET, BLOOMINGTON, ILLINOIS WHEN INSPECTED OCTOBER 2, 1940



DRAWN BY H.V.G.	WILLIAMS OIL-O-MATIC HEATING CORPORATION BLOOMINGTON, ILLINOIS	MERCOID EXHIBIT H-2
APPROVED BY Q.H.P.		DATE Oct. 2, 1940
		SHEET NO.

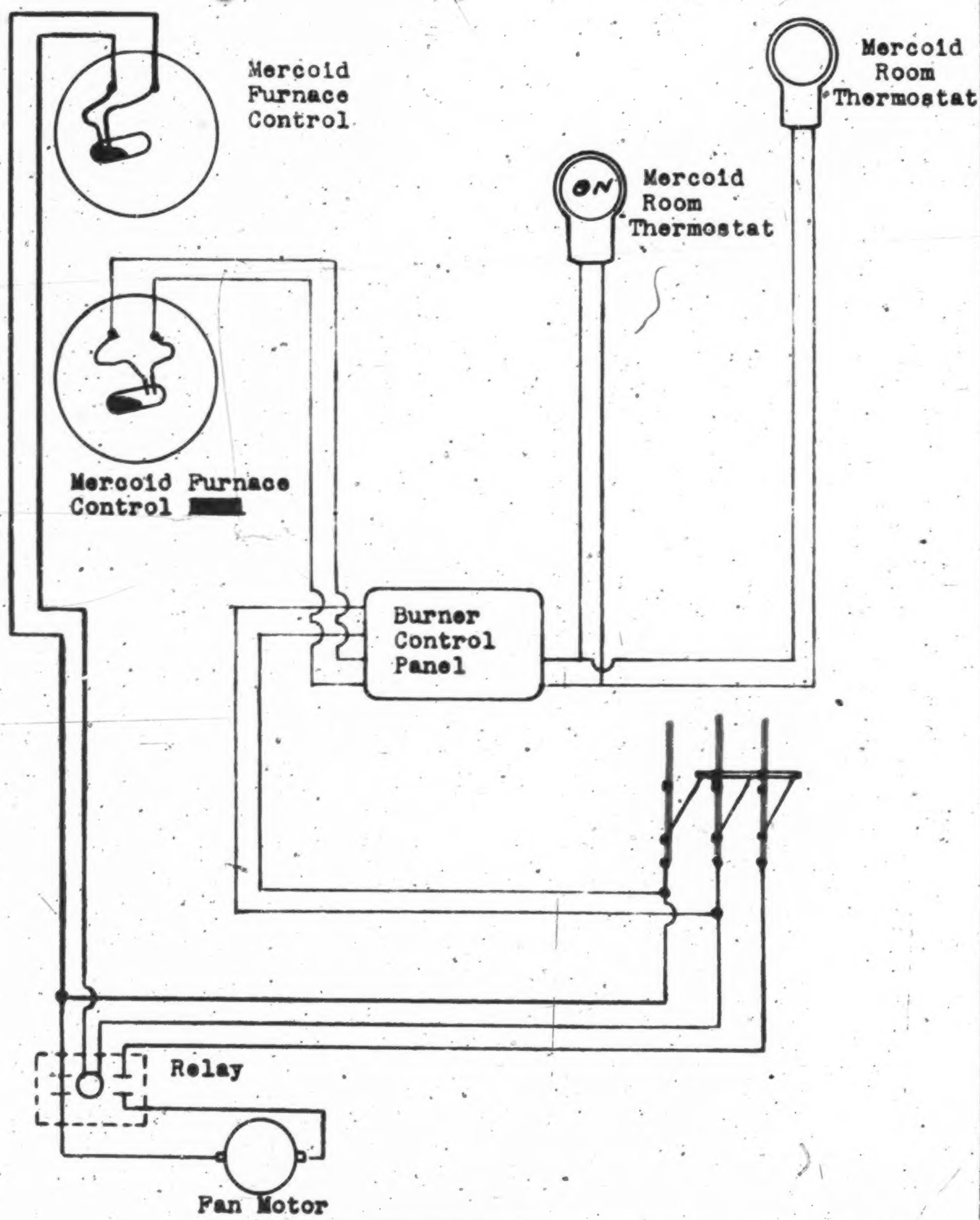
WIRING DIAGRAM OF INSTALLATION IN EVANGELICAL CHURCH, LEE AND FRONT STREET, BLOOMINGTON, ILLINOIS WHEN INSPECTED OCTOBER 2, 1940



MERCOID EXHIBIT H-3

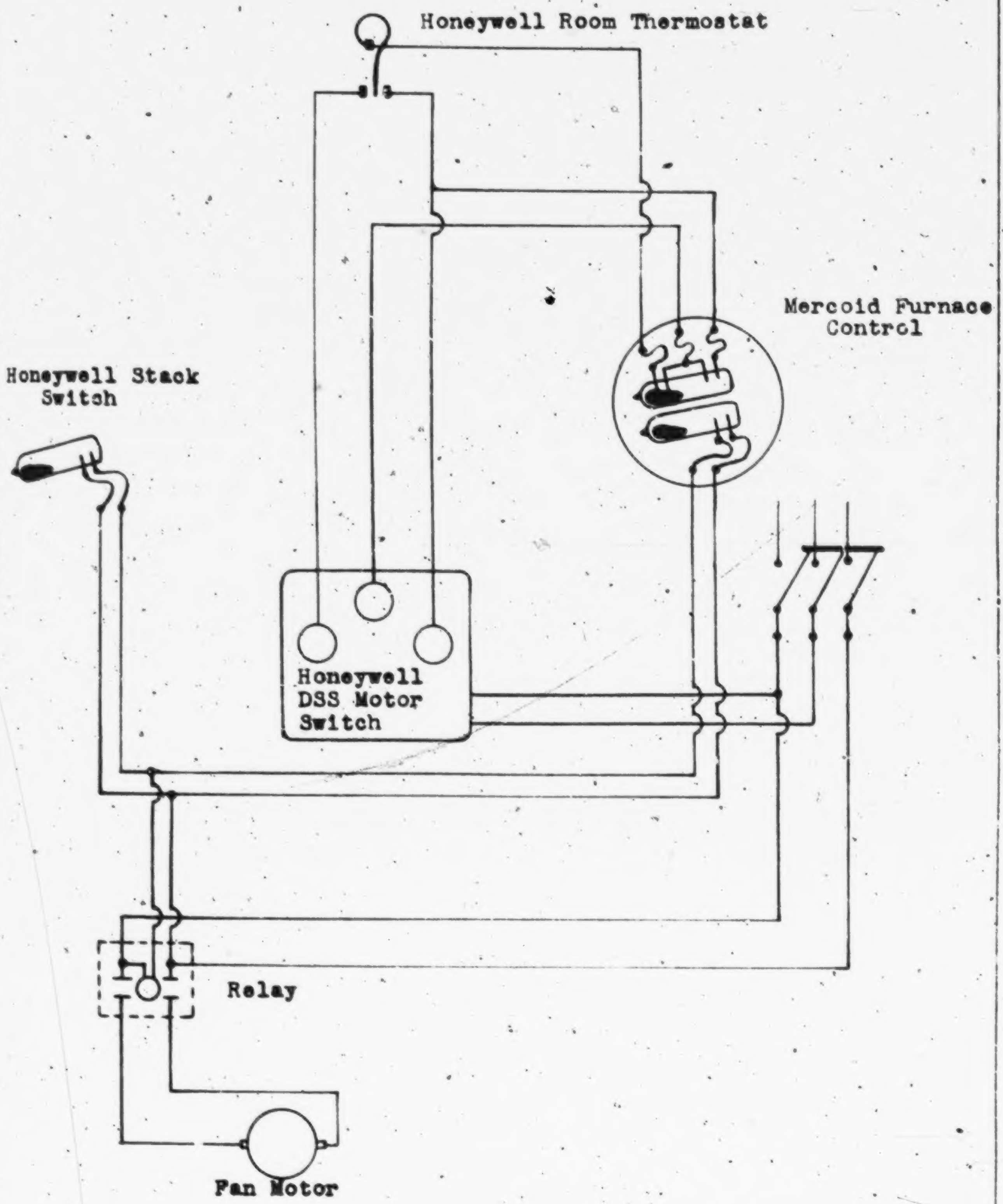
DRAWN BY H.V.G.	WILLIAMS OIL-O-MATIC HEATING CORPORATION BLOOMINGTON, ILLINOIS	DATE Oct. 2, 1940
APPROVED BY Q.H.P.		SHEET NO.

WIRING DIAGRAM OF INSTALLATION IN EVANGELICAL CHURCH, LEE AND FRONT STREET, BLOOMINGTON, ILLINOIS WHEN INSPECTED OCTOBER 2, 1940



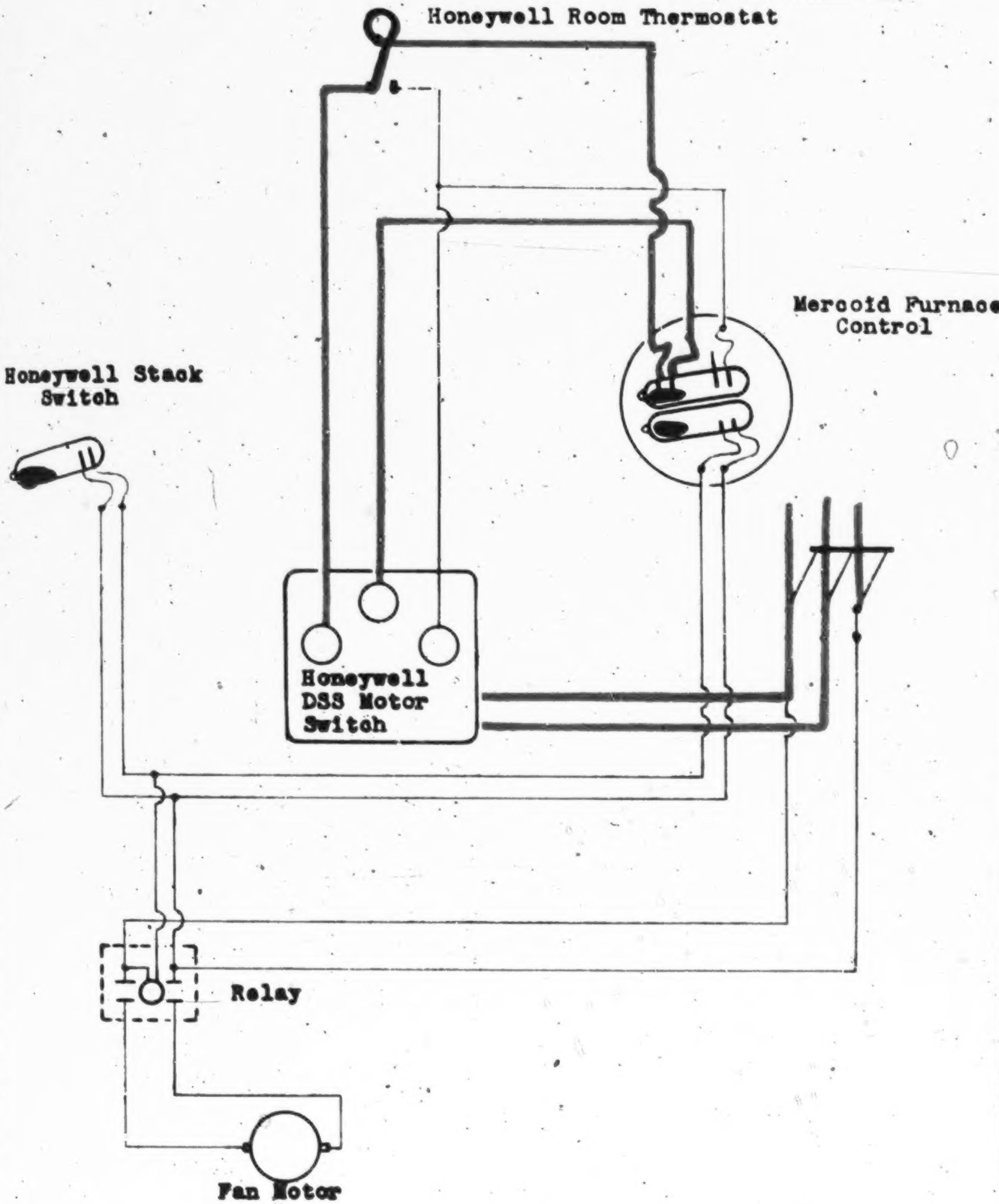
DRAWN BY H.V.G. APPROVED BY R.H.P.	WILLIAMS OIL-O-MATIC HEATING CORPORATION BLOOMINGTON, ILLINOIS	MERCOID EXHIBIT H-4 DATE Oct. 2, 1940 SHEET NO.

WIRING DIAGRAM OF INSTALLATION IN RESIDENCE OF NED E. DOLAN, 301 N. MERCER AVE., BLOOMINGTON, ILLINOIS WHEN INSPECTED ON OCTOBER 2, 1940.



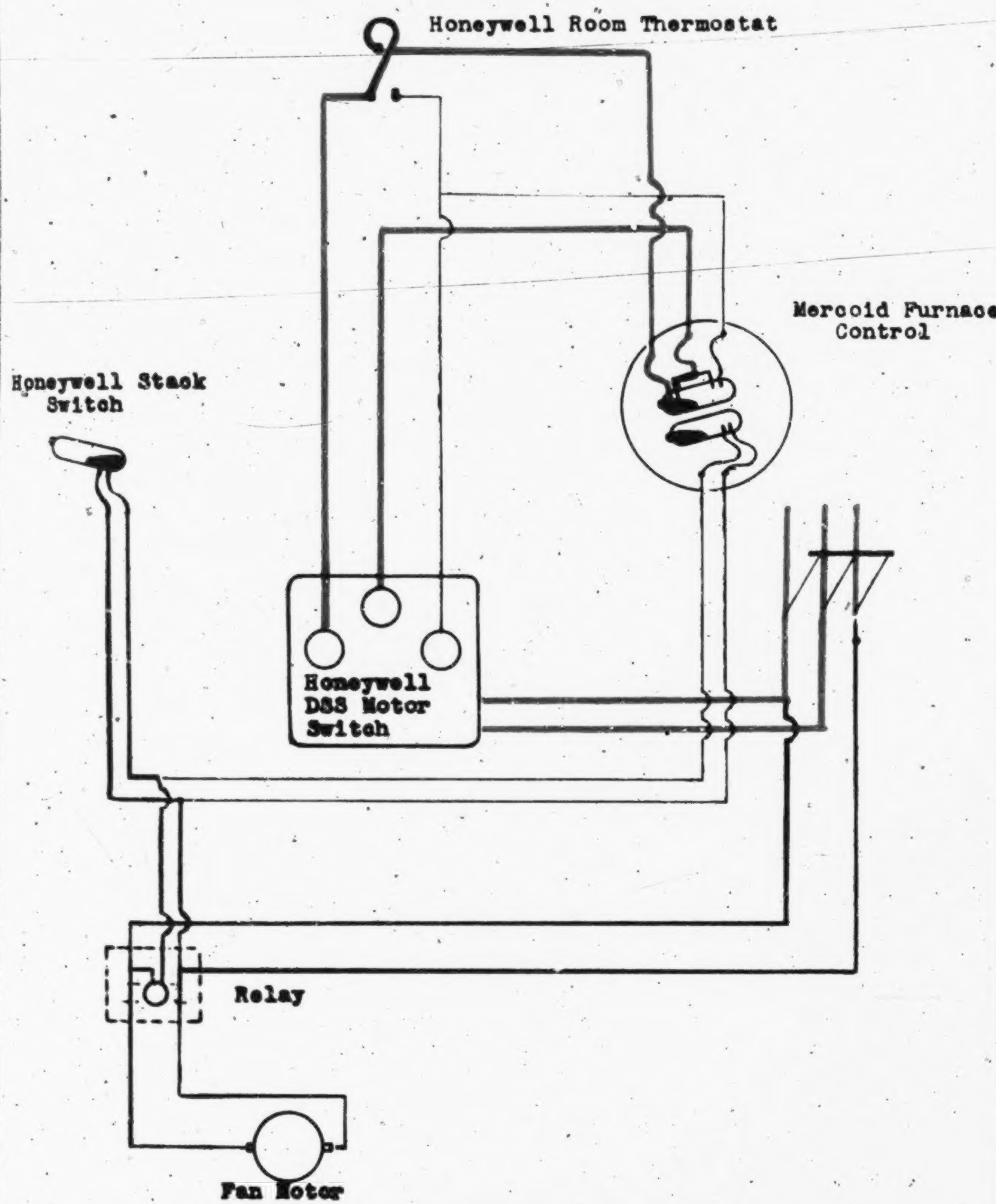
Drawn By H.V.G.	WILLIAMS OIL-O-MATIC HEATING CORPORATION BLOOMINGTON, ILLINOIS	MERCOID EXHIBIT I-1
Approved By A.K.P.		Date Oct. 2, 1940
		Sheet No.

WIRING DIAGRAM OF INSTALLATION IN RESIDENCE OF NED E. DOLAN, 301 N. MERCER AVE., BLOOMINGTON, ILLINOIS WHEN INSPECTED ON OCTOBER 2, 1940.



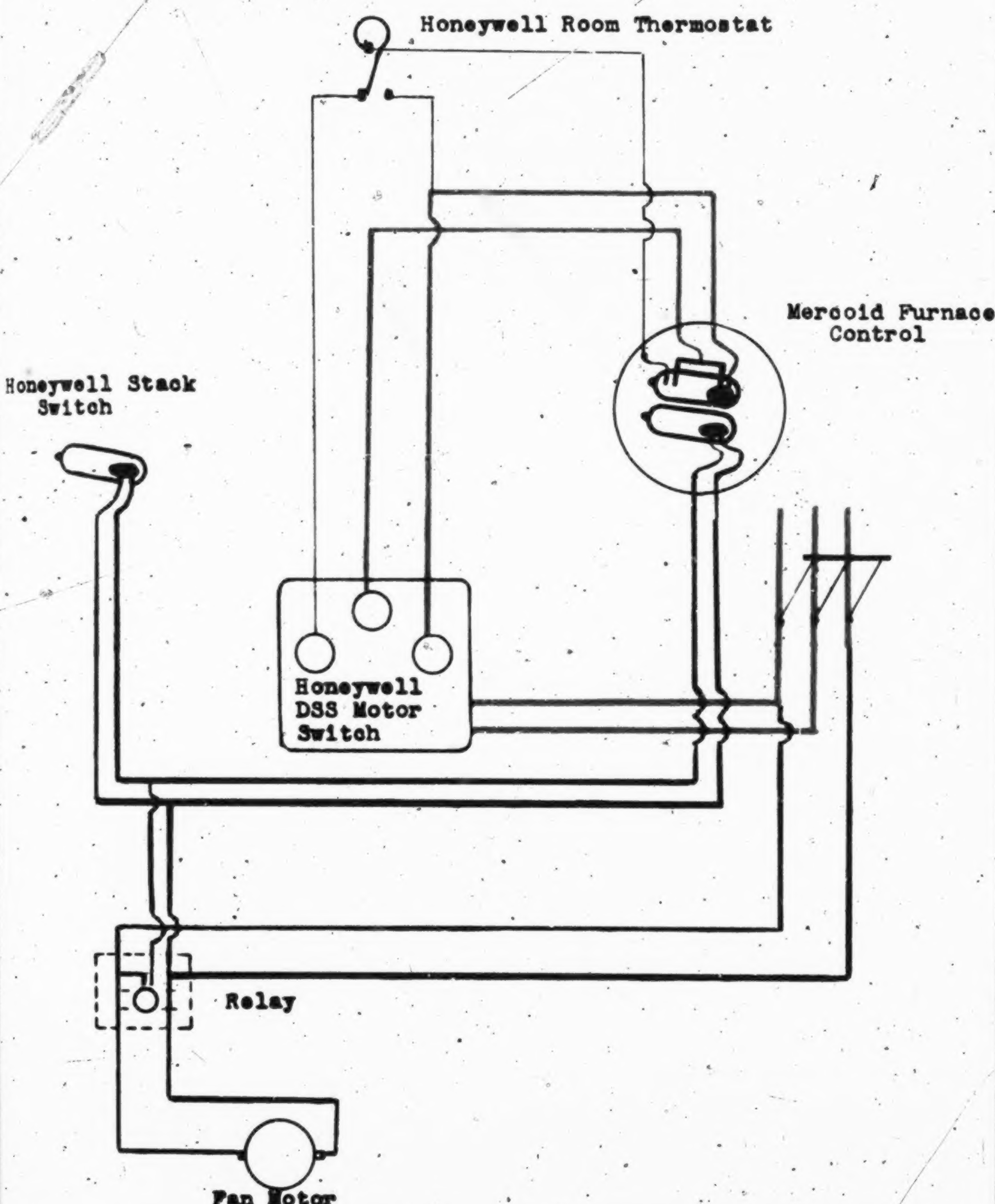
Drawn by H.V.G.	WILLIAMS OIL-O-MATIC HEATING CORPORATION BLOOMINGTON, ILLINOIS	MERCOID EXHIBIT I-2
Approved by A.H.P.		Date Oct. 2, 1940
		Sheet No.

WIRING DIAGRAM OF INSTALLATION IN RESIDENCE OF
NED E. DOLAN, 301 N. MERCER AVE., BLOOMINGTON,
ILLINOIS WHEN INSPECTED ON OCTOBER 2, 1940.



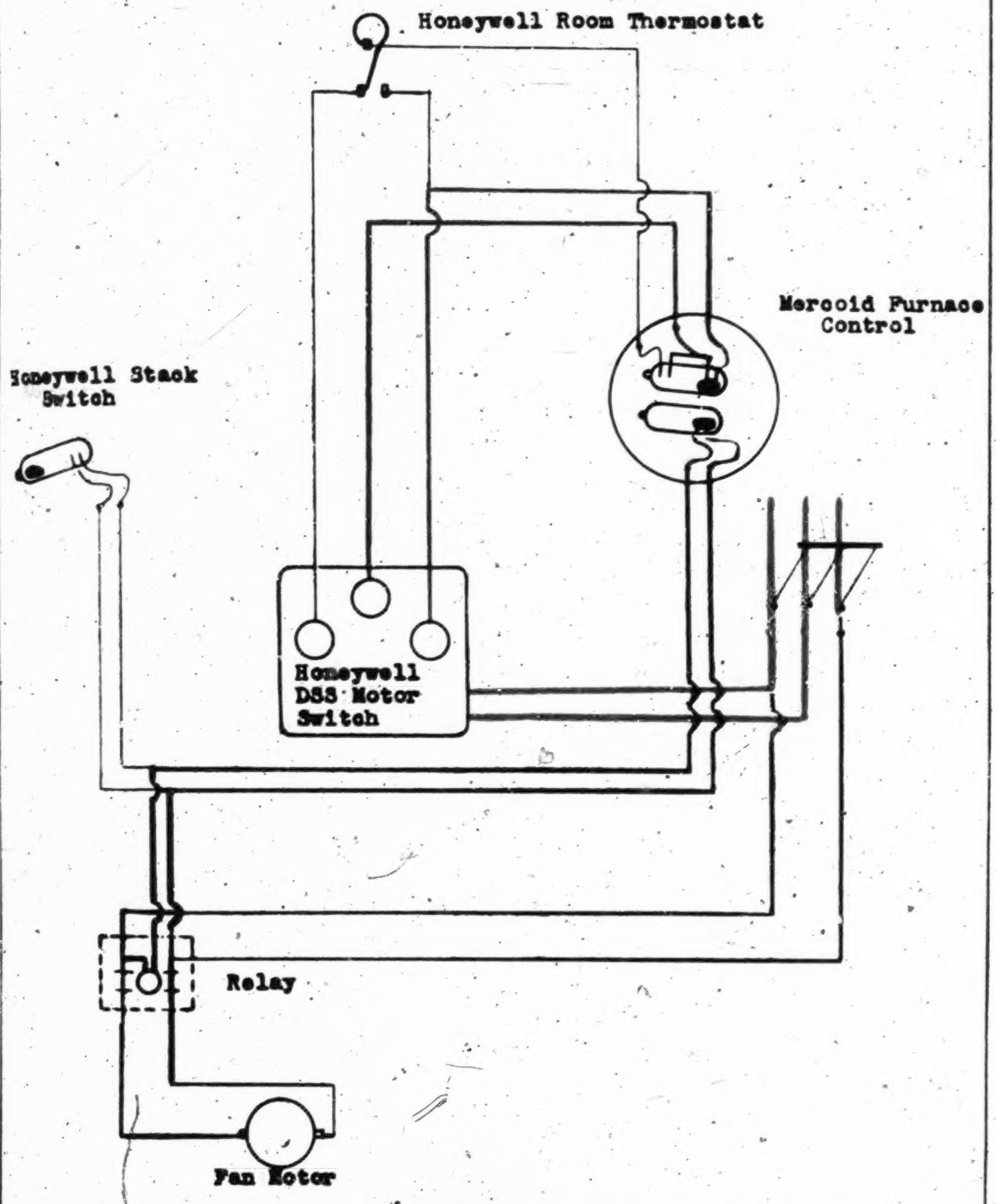
DRAWN BY H.V.G.	WILLIAMS OIL-O-MATIC HEATING CORPORATION BLOOMINGTON, ILLINOIS	MERCOID EXHIBIT I-3
APPROVED BY Q.H.P.		DATE Oct. 2, 1940
		SHEET NO.

WIRING DIAGRAM OF INSTALLATION IN RESIDENCE OF
NED E. DOLAN, 301 N. MERCER AVE., BLOOMINGTON,
ILLINOIS WHEN INSPECTED ON OCTOBER 2, 1940.



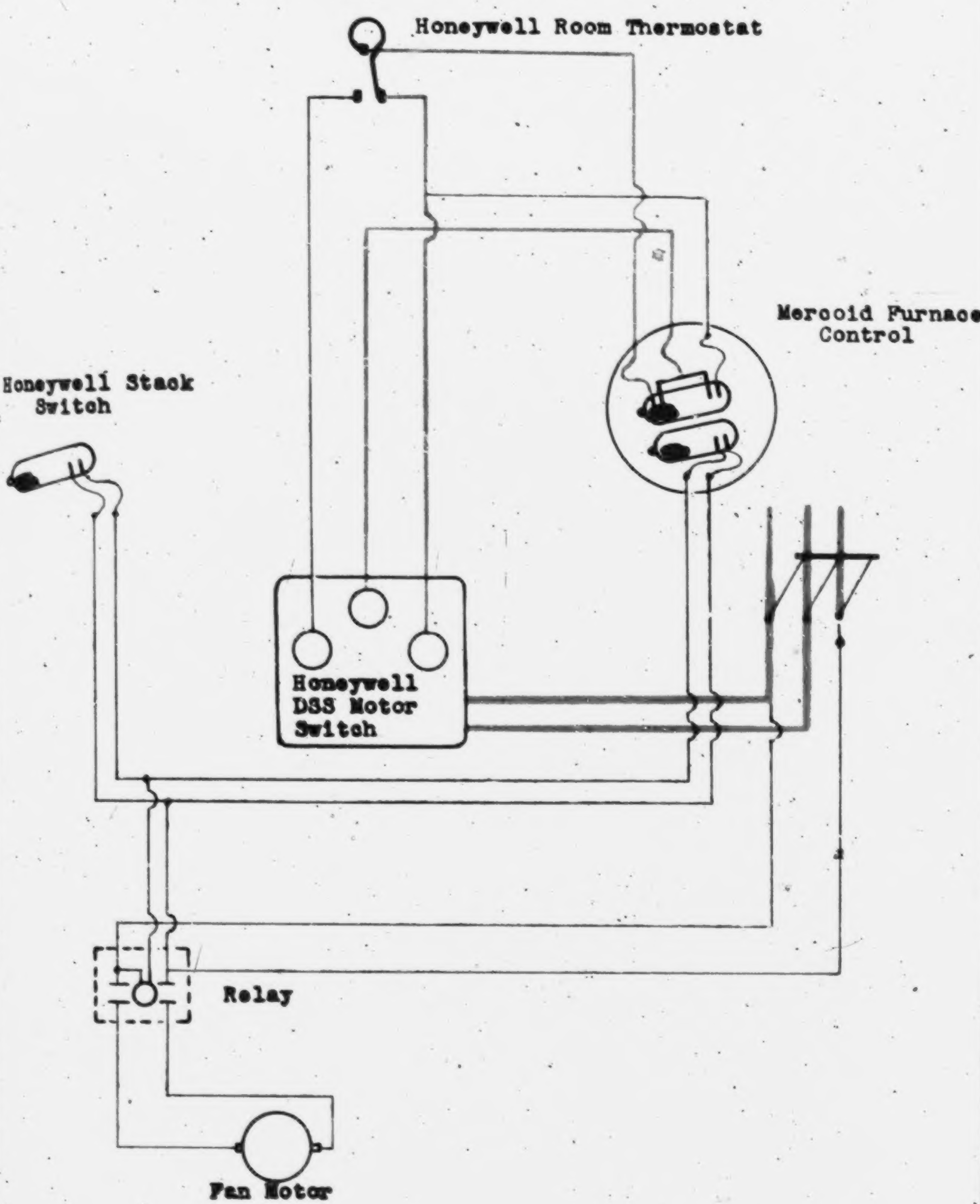
Drawn By H.V.G.	WILLIAMS OILOMATIC HEATING CORPORATION BLOOMINGTON, ILLINOIS	MERCOID EXHIBIT I-4
Approved By Q.K.P.		Date Oct. 2, 1940
		Sheet No.

WIRING DIAGRAM OF INSTALLATION IN RESIDENCE OF NED E. DOLAN, 301 N. MERCER AVE., BLOOMINGTON, ILLINOIS WHEN INSPECTED ON OCTOBER 2, 1940.



DRAWN BY H.V.G.	WILLIAMS OIL-O-MATIC HEATING CORPORATION BLOOMINGTON, ILLINOIS	MERCOID EXHIBIT I-5
APPROVED BY Q.K.P.		DATE Oct. 2, 1940
		SHEET NO.

WIRING DIAGRAM OF INSTALLATION IN RESIDENCE OF NED E. DOLAN, 301 N. MERCER AVE., BLOOMINGTON, ILLINOIS WHEN INSPECTED ON OCTOBER 2, 1940.



DRAWN BY H.V.G.	WILLIAMS OIL-O-MATIC HEATING CORPORATION BLOOMINGTON, ILLINOIS	MERCOID EXHIBIT I-6
APPROVED BY Q.H.P.		DATE Oct. 2, 1940
		SHEET NO.

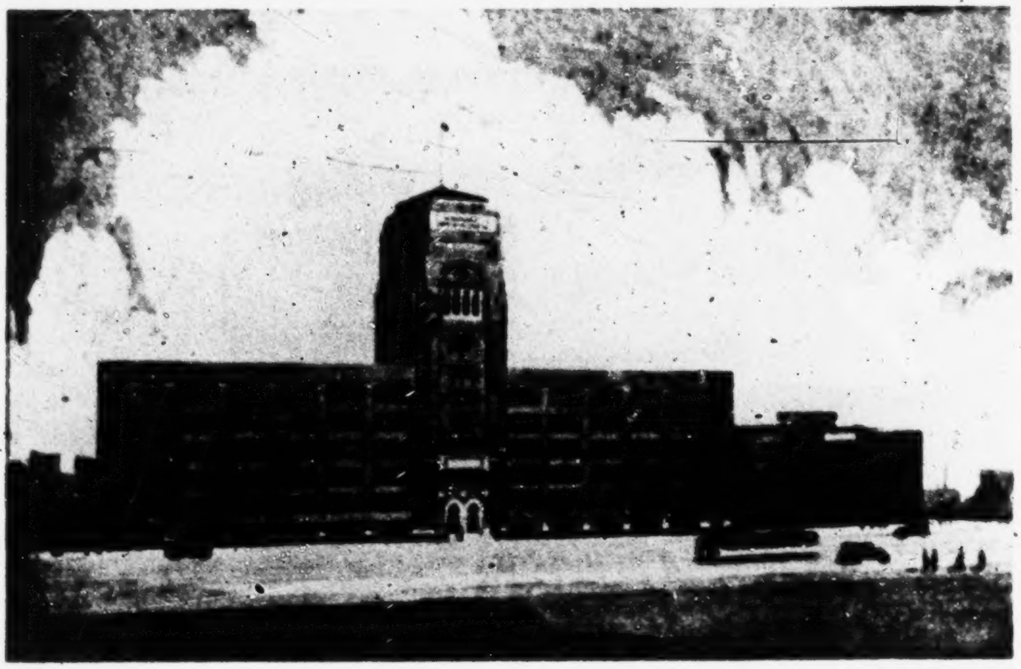
MINNEAPOLIS-HONEYWELL REGULATOR CO.

EXECUTIVE OFFICES

MINNEAPOLIS, MINN.

FACTORIES

MINNEAPOLIS, MINN. WABASH, IND., U. S. A.



View of Minneapolis, Minn., Plant

BRANCH OFFICES:

New York City	Chicago	Philadelphia
Milwaukee	St. Paul	Cleveland
Boston	Detroit	St. Louis

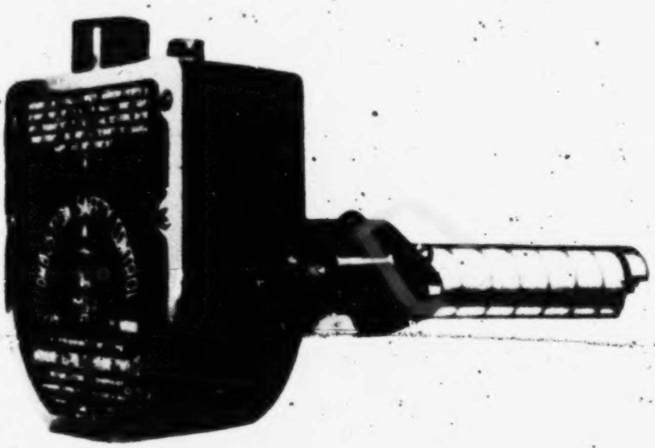
Mercoid Exhibit J-1

MERCOID EXHIBIT J-1

TYPE B COMBUSTION SAFETY CONTROL

THE *Combustion Safety Control is designed to be used with the Type DSS Motor Switch* or Type DSSV Motor Switch Valve—and together they control the safe operation of the burner.

The actuating element is a coil of bi-metallic metal, which responds to the changes in temperature—approximately 100° change will cause it to function, and as the instrument is ordinarily installed in the stack this change is brought about in a very few seconds. In the head of the instrument on the end of the shaft to which the thermostatic element is attached are 2 mercury tube type switches. As the bi-metallic element expands or contracts, the high and low volt switches are tilted.



When the room Thermostat calls for heat and the Motor Switch enters the starting cycle, no heat passes up the stack if combustion fails to take place. Consequently, the Combustion Safety Control remains in the cold position, leaving the burner motor circuit open in the high voltage tube, so that at the completion of the Motor Switch's ignition cycle, the burner motor stops. This prevents an abnormal discharge of oil.

If the flame is extinguished in some manner before the burner motor has been shut off, the drop in stack temperature will cause the element of the Combustion Safety Control to contract and break the circuit to the burner motor. At the same time the circuit to the burner motor is broken, the circuit is established through the low voltage tube of the Combustion Safety Control to the Motor Switch, which will cause it to recycle and give the oil burner one more chance to function correctly. If combustion fails to take place, then the Combustion Safety Control will remain in the cold position and the burner will be locked up.

If current fails while the burner is on, the burner motor of course stops, and as the stack cools, the circuit to the Motor Switch is completed in the low voltage tube of the Combustion Safety Control, and is broken in the high voltage tube to the burner motor. When current service is resumed the burner motor will be off, but the Motor Switch will automatically recycle, again starting it.

To meet Underwriters' requirements, the electrical circuit between the DSS Motor Switch and the Combustion Safety Control is so arranged that the System will not function when the Combustion Safety Control is disconnected.

MERCOID EXHIBIT J-3

Mercoid Exhibit J-3

MINNEAPOLIS HEAT REGULATOR CO.

GENERAL OFFICE AND FACTORY
MINNEAPOLIS
MINNESOTA

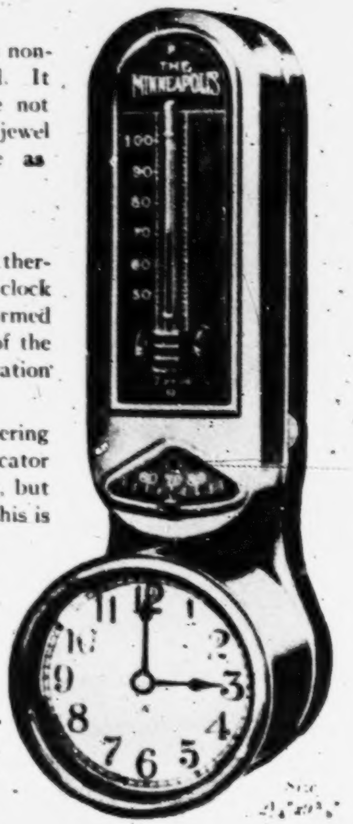
Established 1885

BRANCH OFFICES:

New York City
Milwaukee
Chicago
St. Paul
Philadelphia
Cleveland

Baltimore
Boston
Buffalo
Cincinnati
Denver
Detroit
Kansas City
Omaha
Portland, Ore.
Pittsburgh
Seattle
St. Louis
Syracuse

Model 55 Eight-Day Thermostat



THE Model 55 Thermostat is equipped with a plain non-jewel clock of the highest quality manufactured. It is reliable in its operation, although of course not possessing the time-keeping qualities of the jewel movement clock, nor will it continue to give as long and satisfactory service.

OPERATION

The mainspring of the clock is not required to move the thermostat indicator, as this produces an uneven strain on the clock spring, affecting its time-keeping qualities, this action is performed by the mechanism built into the thermostat. The function of the clock being simply to trip this mechanism similar to the operation of an alarm clock.

The range of the automatic throw of the indicator, both lowering at night and raising in the morning, is adjustable. The indicator can not only be lowered to any desired degree of temperature, but it can also be raised to any desired degree of temperature. This is possible only with "MINNEAPOLIS" eight-day thermostats.

The adjustment of the point to which the indicator lowers at night and raises in the morning, is made by the adjustable discs on the side of the thermostat, and this adjustment can be altered at will.

The thermostat temperature indicator can be moved at any time without in any way affecting the automatic action of the thermostat, and without disengaging the clock control.

The Model 55 Thermostat is finished in sand blast bronze.

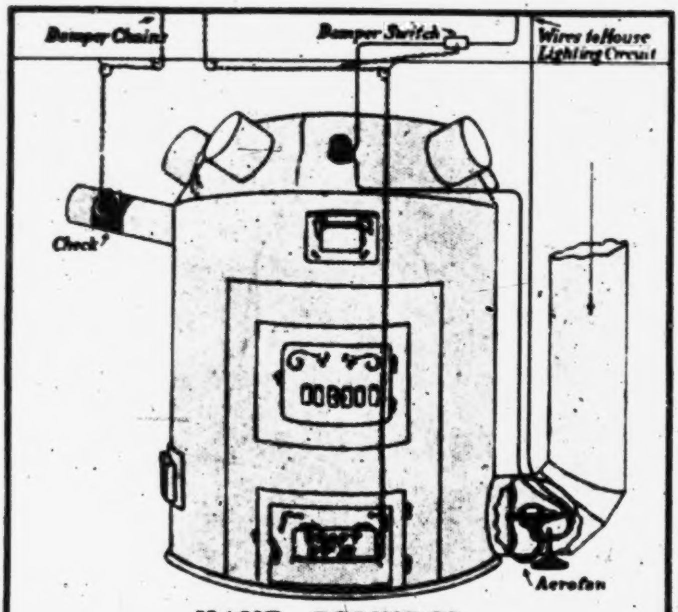
View of Thermostat Assembling Department

Heating Specialties

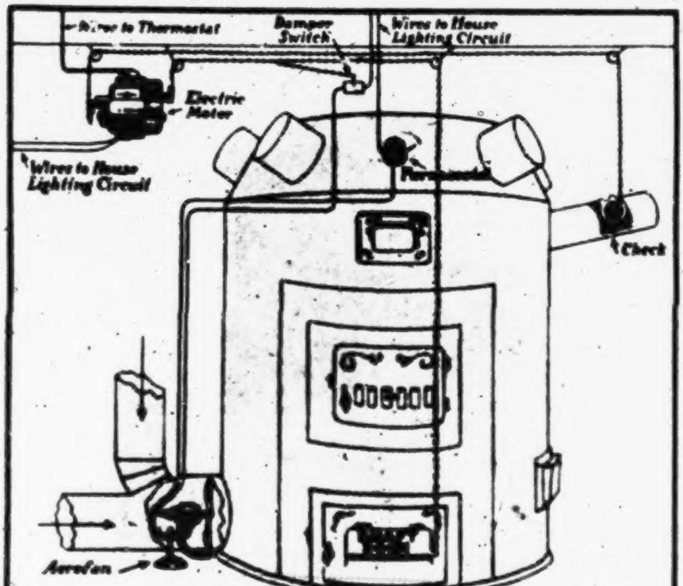
HONEYWELL
Heating Specialties Company
Wabash, Indiana

Mercoid Exhibit
J-4

Aerofan Installation



HAND CONTROL



AUTOMATIC CONTROL

AGREEMENT

AGREEMENT entered into this ______ day of March, 1939, by and between MINNEAPOLIS-HONEYWELL REGULATOR COMPANY, a corporation organized and existing under the laws of the State of Delaware and having its principal place of business at Minneapolis, Minnesota, and COOK ELECTRIC COMPANY, a corporation organized and existing under the laws of the State of Illinois and having its principal place of business at Chicago, Illinois.

WITNESSETH:

WHEREAS, Minneapolis-Honeywell Regulator Company is the owner of the following United States Letters Patent:

5-9-39

~~Numbers~~	~~Patentees~~	Dated
1,951,663	John P. Kriechbaum	March 20, 1934
~~1,989,278~~	~~David J. Jones~~	~~January 29, 1935~~

and a pending application of John P. Kriechbaum for Letters Patent, Serial No. 678,429, filed June 30, 1933, for improvements in Control Systems;

WHEREAS, Cook Electric Company is the owner of a pending application of John S. Baker for Letters Patent, Serial No. 735,457, for improvements in Automatic Control System for Warm Air Furnaces, filed July 16, 1934, as a continuation of application, Serial No. 645,555, filed December 3, 1932;

WHEREAS, Interference No. 73,148 was declared by the Commissioner of Patents on August 24, 1936, involving said Kriechbaum application, Serial No. 678,429, and said Baker

application, Serial No. 735.457; and

WHEREAS, it is the desire of the parties to settle said interference and to exchange licenses under the foregoing patents and applications.

5-9-39 Cohorall

3/31/39

NOW, THEREFORE, in consideration of the sum of One Dollar ($1.00) in hand paid, each to the other, and other good and valuable considerations, the receipt of which is hereby acknowledged, the parties hereto agree, each for itself, to perform and observe the covenants, terms and conditions hereof by it to be performed or observed.

1. Said Minneapolis-Honeywell Regulator Company hereby gives and grants unto said Cook Electric Company a non-exclusive, royalty-free license to manufacture, use, sell and install heating systems and apparatus embodying the invention, inventions and/or improvements set forth, disclosed and claimed or intended to be claimed and covered by claims 5 to 8, inclusive, and claims 21 to 25, inclusive, of said United States Letters Patent No. 1,951,663, granted to John P. Kriechbaum on March 20, 1934, for and during the life of said patent, and any and all other claims thereof as might be infringed by said Cook Electric Company in exercising its right hereunder to manufacture, use, sell and install such heating systems and apparatus embodying the subject matter covered by said claims 5 to 8, inclusive, and claims 21 to 25, inclusive.

5-9-39 Cohorall

2. Said Minneapolis-Honeywell Regulator Company hereby also gives and grants unto said Cook Electric Company a non-exclusive, royalty-free license to manufacture, use, sell and install heating systems and apparatus embodying the invention.

5-9-39 Cohorall

inventions and/or improvements set forth, disclosed and claimed or intended to be claimed and covered by claims 4, 9 and 11 of said United States Letters Patent No. 1,989,278, granted to David J. Jones on January 25, 1935, for and during the life of said patent, and any and all other claims thereof as might be infringed by said Cook Electric Company in exercising its right hereunder to manufacture, use, sell and install such heating systems and apparatus embodying the subject matter covered by said claims 4, 9 and 11.

3. Said Minneapolis-Honeywell Regulator Company hereby consents to and agrees to deliver to said Cook Electric Company, upon the execution of this agreement, a concession of priority of invention, unto John S. Baker, of the subject matter of the counts forming the issue of said interference No. 73,148 and all common subject matter disclosed in both said applications to-wit: Serial Nos. 678,429 and 645,555.

4. Said Cook Electric Company hereby gives and grants unto said Minneapolis-Honeywell Regulator Company a non-exclusive, royalty-free license to manufacture, use, sell and install heating systems and apparatus embodying the subject matter covered by or intended to be covered by the counts forming the issue of said interference and all common subject matter disclosed in both said applications and any and all other claims of said Baker application or patent that will issue thereon as might be infringed by said Minneapolis-Honeywell Regulator Company in exercising its rights hereunder to manufacture, use, sell and install heating systems and apparatus embodying the subject matter covered by said counts forming said interference issue and common to both said applications; and said Minneapolis-Honeywell Regulator Company hereby

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gives and grants unto said Cook Electric Company a non-exclusive, royalty-free license under any and all claims in said Kriechbaum application or patent that will issue thereon as might be infringed by said Cook Electric Company in the manufacture, use, sale and installation of heating systems and apparatus embodying the subject matter disclosed in said Baker application or patent that will issue thereon.

5. Each of the parties agrees that it will pay the final government fee in its application involved in said interference No. 73,148, and will issue the patent thereon.

6. The licenses herein granted to each of the parties by the other shall only be assignable by the licensee in connection with the sale of its entire business relating to the temperature control field, and shall not give any right to the licensee, either expressly or by implication, to grant sub-licenses thereunder.

7. The acceptance of a license this day by Cook Electric Company from Minneapolis-Honeywell Regulator Company under a Freeman Patent No. 1,813,732, does not impliedly give any right to the latter company to grant sub-licenses to its other licensees under said Freeman Patent on two-speed operation as covered by said Baker application or any other application or patent owned or controlled by Cook Electric Company.

8. Each party hereto acknowledges the validity of the other party's patents, or patents to issue, under which cross licenses are granted herein by the present instrument, and will not deny or contest their validity or aid others in so doing, the application of this paragraph being limited to those claims of the herein-referred-to ~~patents and~~ patents to issue under which each of the parties has granted licenses to the other.

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9. Said Minneapolis-Honeywell Regulator Company hereby waives any and all claims it may have against Cook Electric Company for past infringement of said Kriechbaum Patent No. 1,951,663 and said Jones Patent No. 1,989,278.

IN WITNESS WHEREOF, the parties hereto have duly caused this instrument to be executed by their proper officers thereunto duly authorized on the day and year first above written.

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

By Charles B. Sweatt
Vice President

Attest:

Charles E. Dunwiddie
Secretary

COOK ELECTRIC COMPANY

By ______________________

Attest:

____

RECORDED
U.S. PATENT OFFICE
Conway P. Coe
Commissioner of Patents
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MERCOID EXHIBIT O.

1315 WILLARD L. HUFF, called as a witness on behalf of the plaintiff, having been first duly sworn, testified as follows:

Direct Examination by Mr. Moore.

Q. 1. Will you please state your name, age, residence and occupation?

A. Willard L. Huff; 52; Minneapolis, Minnesota; manufacturer.

Q. 2. Are you an officer of the Minneapolis-Honeywell Regulator Company?

A. I am.

Q. 3. What office do you hold?

A. Vice president and treasurer.

Q. 4. How long have you been vice president?

A. Since the organization of the company, in October, 1927.

Q. 5. And how long have you been treasurer?

A. I have held those two offices—I was originally treasurer and subsequently made vice president and treasurer, I think, in 1929.

Q. 6. Who was the predecessor of the Minneapolis-
1316 Honeywell Regulator Company?

A. The Minneapolis Heat Regulator Company of Minneapolis, Minnesota, and the Honeywell Heating Specialties Company of Wabash, Indiana.

Q. 7. Did you hold an office in either of the predecessors.

A. Yes. I was secretary and treasurer of the Honeywell Company.

Q. 8. As vice president of the Minneapolis-Honeywell Company, are you authorized by the board of directors under the by-laws of the corporation to execute contracts or licenses in the name of the corporation?

A. I am.

Q. 9. Are there any other officers who are also authorized to do the same?

A. Several, yes.

Q. 10. Can you name them?

A. Mr. H. W. Sweatt, president; and Mr. C. B. Sweatt, vice president; Mr. Charles C. Buckland, secretary; Mr. M. C. Honeywell, chairman of the board; and Mr. Richard P. Brown, vice president.

Q. 11. Would each one of these officers be advised as to any contracts or licenses which have been executed by any of the other officers?

1317 A. Well, with certain exceptions, because of their absence from Minneapolis, both Mr. Brown and Mr. Honeywell might not be advised.

Q. 12. But the president, Mr. Harold Sweatt, and you and Mr. Charles B. Sweatt would know of any licenses granted under any of the patents owned by Minneapolis-Honeywell, would you not?

A. In all probability, yes.

Q. 13. Now, Minneapolis-Honeywell has introduced or furnished Mercoid copies of licenses under the Freeman patent granted to the Cook Electric Company, the Penn Electric Switch Company, Perfex Corporation, Bendix Aviation Corporation, and White-Rodgers Company. You are familiar with those licenses, are you not?

A. I am.

Q. 14. I believe you executed the last three for the corporation.

Mr. Freeman: Do not the copies show who executed them, Mr. Moore?

Mr. Moore: Yes, they do, but I just want to show he was personally familiar.

Mr. Freeman: If they have his name on, we will concede they were signed by Mr. Huff, and we furnished them to you.

1318 Mr. Moore: Yes.

A. Of course these were signed by typewriter and I assume that I did sign them.

Q. 15. And there was a price schedule furnished also relating to these contracts or licenses, and I believe that accompanied each one of the licenses, did it not?

A. Yes.

Q. 16. Your letter of May 7, 1940, has been set up by the Mercoid in the pleadings, and I notice that it is addressed to Mr. C. J. Swan, Detroit Lubricator Company, and Mr. Ira McCabe of the Mercoid Corporation. Was

Minneapolis-Honeywell negotiating the granting of a license to the Detroit Lubricator Company at that time?

A. Yes.

Q. 17. Do you know whether or not a license was ever executed?

A. It was not executed by Detroit Lubricator Company.

Q. 18. Do you know if any other agreement than a typed or printed license was made with the Detroit Lubricator in relation to the Freeman patent or for the sale of the combination furnace control, such as defined in the printed form of this license?

A. Will you read the first part of that question, please?

1319 Mr. Moore: Will you read it?

(Q. 18 was thereupon read.)

A. The answer is that they took no license.

Q. 19. As treasurer of the Minneapolis-Honeywell, did Minneapolis ever receive from Detroit Lubricator any money or other consideration for or involving the sale of combination furnace controls such as defined in the license?

A. No.

Q. 20. And sold by Detroit Lubricator?

A. The answer is no.

Q. 21. Now, in this price schedule A, which was attached to and forming a part of the licenses heretofore referred to, the manufacturer's price, the net minimum price for a combination furnace control shall be $5.25. Is that correct?

A. That is correct.

Q. 22. I show you here a Detroit Lubricator Company manufacturer's price sheet, effective January 20, 1941, and ask you if that does not set forth the same price as your furnace limit and blower controls, that is, a combination blower and limit control.

Mr. Freeman: That is objected to as immaterial. There is no showing at all that Minneapolis had anything to

1320 do with the Detroit Lubricator Company; that as to the price list of Detroit Lubricator Company, it is the best evidence.

Q. 23. You may answer.

A. My answer would be that I am not familiar at all with the Detroit Lubricator Company's price list. Their

number applied to this particular item, which you describe, is not familiar to me and I am not certain whether their defined combination blower and limit is comparable to what we call our combination furnace and fan control.

Q. 24. What is the price set opposite?

A. $5.25.

Q. 25. Which is the same as the price set up in the price schedule A; is it not?

A. Yes.

Mr. Moore: A photostat of Detroit Lubricator Company, manufacturer's price sheet, effective January 20, 1941, is offered in evidence as MERCOID EXHIBIT K.

Mr. Freeman: That is objected to as not properly proven, and for the further reason that it is immaterial.

(The document was so marked.)

Q. 26. Referring to the licenses I showed you at first to Cook Electric and the others, have any of these
1321 licenses, to your knowledge, been modified or amplified since the date of execution by letters or other communications in writing?

A. It is my recollection that the original licenses were slightly altered at the time the license was granted to the St. Louis Company, White-Rodgers Electric Company.

Q. 27. Was that the only license that was altered?

A. No; I say the first licenses granted, as I recall it, were slightly altered at the time a license was issued to White-Rodgers Electric Company.

Q. 28. And that was about the first of April, 1940?

A. I do not recall the date, but that is approximately right.

Q. 29. You have submitted a copy of this same license to The Mercoid Corporation, have you not?

A. I think it was an identical copy, yes.

Q. 30. And have you submitted the same license to other control manufacturers?

A. You mean in addition to those who have taken the license?

Q. 31. Yes.

A. A copy was submitted to Mr. Swan.

Q. 32. Of Detroit Lubricator Company?

A. Of the Detroit Lubricator.

1322 Q. 33. Now, calling attention to your letter of May 7, 1940, addressed to Mr. Swan and Mr. McCabe, there

were two carbons attached to that letter, and you state in this letter:

"In connection with the printed form of licensing agreement which I handed to you in Chicago last week, I should at the same time have furnished you with copies of the attached letters, both of which have become a part of this agreement, in the cases where licenses have been granted and these same conditions would apply in connection with any new licenses issued."

I call your attention to that letter and also to the carbons attached to it. Now, are those the changes that were submitted to the White-Rodgers Company that you have just referred to?

A. They were, except I want to call your attention to a typographical error which appears in the second carbon copy of the letter, where a reference is made to 25 per cent, which should have read 25 cents.

Q. 34. I call your attention to your letter of October 7, 1940, addressed to Mr. Ira E. McCabe, which has been set up in the pleadings by Mercoid, and ask you if that is not a notice of that error that you spoke of?

1323 A. That is correct.

Q. 35. Now, these two carbons attached to your letter of May 7th, which you say were submitted to White-Rodgers, calling attention to an error in the second one, were they dictated by Mr. Harold W. Sweatt, the president of the company?

A. I cannot be sure, but it would appear from this carbon copy that that was the case.

Q. 36. His initials appear in the lower left hand corner?

A. That is true.

Q. 37. And the same in the second one?

A. That is right.

Q. 38. Now, were these same changes submitted to the other licensees who had already obtained licenses at that time?

A. I do not know at what time they were submitted to the other licensees, but they were submitted.

Q. 39. So all of the present licensees that I have referred to here did receive this change or amendment to the license?

A. I think that is true.

Q. 40. In your letter of October 7th you stated:

"It has just been called to my attention that with
1324 my letter of May 7, 1940, addressed to you;"
and you refer to that typographical error.

A. The answer is yes.

Q. 41. Who called that to your attention?

A. I do not recall.

Q. 42. It was called to your attention apparently just before you wrote this letter, was it not?

A. Apparently so.

Q. 43. Yes.

A. I am not sure.

Q. 44. Do you happen to know when this controversy between Minneapolis-Honeywell and Mercoid Corporation first arose by filing of the suit; do you remember the date?

A. It was my impression it was some time during 1940.

Q. 45. Yes. The record shows that The Mercoid Corporation vs. Minneapolis was filed on June 29, 1940.

Mr. Freeman: That really is the best evidence, is it not, Mr. Moore?

Mr. Moore: Yes.

Q. 46. So this typographical error then occurred from the time that you submitted the letter to the Mercoid on May 7, 1940, until just prior to October 7, 1940?

Mr. Freeman: The record so shows.

1325 A. (No answer.)

Q. 47. These two amendments to your license agreement attached to your letter of October 7th are carbon copies. Do you know whether the original of these carbon copies was actually mailed to any of the licensees that you have referred to?

A. Well—

Mr. Freeman: Do you mean with the typographical error, Mr. Moore?

Mr. Moore: No, I did not say anything about the typographical error.

Mr. Freeman: The carbon copies include the typographical error.

Mr. Moore: And I asked him if the original were sent out to any of the licensees.

A. As I recall it, the originals which were a part of the first licenses granted did not carry that error; that the typographical error occurred at the time I submitted these two supplemental letters to Mercoid Corporation and to Detroit Lubricator Company.

Q. 48. When you were with the Honeywell Heating Specialties Company, the Honeywell Heating Specialties Company also sold warm air furnace controls, did they not?

A. That is true.

1326 Q. 49. And also sold fan controls?

A. I imagine we did. I cannot be certain.

Q. 50. Did the Honeywell Specialties Company sell as a unit a room thermostat, a furnace fan control and a warm air furnace limit control?

A. I cannot be certain of the one element. I am sure we sold thermostats as units, and I am sure we sold limit controls as such, but I cannot be sure at that time that we manufactured a fan switch.

Q. 51. Your catalog of 1925 and 1926 would show whether or not you manufactured a fan control?

A. It should.

Mr. Freeman: What is the name of that catalog, Mr. Moore, so we might look it up too?

Mr. Moore: I will give you a copy of it.

Mr. Freeman: All right.

Mr. Moore: It is in the other depositions, the Bloomington depositions. The Honeywell Heating Specialties Company of Wabash, Indiana, 1925-1926.

Mr. Freeman: What is the exhibit number?

Mr. Moore: It was Mercoid's Exhibit J-2, in the Bloomington depositions.

Q. 52. You stated that the Detroit Lubricator Company never did execute a license on the Freeman patent?

1327 A. That is correct.

Mr. Freeman: That is objected to as already having been answered once.

Q. 53. Did they give any reason?

Mr. Freeman: That is objected to as immaterial.

Q. 54. You may answer.

A. Should I answer the question?

Mr. Freeman: Sure.

Q. 55. Yes.

A. There was apparently some difference of opinion as between the management of the company—I am speaking of Detroit Lubricator Company—in their patent department as to whether or not they should take this license.

Mr. Moore: Direct examination closed.

Cross-Examination by Mr. Freeman:

X-Q. 56. Mr. Huff, prior to the letter of May 7, 1940, wherein a typographical error occurred, had you discussed with Mr. McCabe the taking of a license under the Freeman patent?

A. I think I discussed it with Mr. McCabe. I am very certain that I discussed it on more than one occasion with Mr. Courteol, president of Mercoid Corporation.

1328 X-Q. 57. Did you at that time make any mention with respect to 25 per cent as is specified in the letter of May 7, 1940?

A. I am certain that I did not.

X-Q. 58. Did you at that time make any mention of 25 cents?

A. I think probably I did not, because these supplemental letters, as I recall, came to my attention after I submitted to both Mr. McCabe and Mr. Swan a printed copy of the licensing agreement.

Mr. Freeman: That is all.

Mr. Moore: No redirect examination.

Deposition closed.

1329 HAROLD W. SWEATT, called as a witness on behalf of plaintiff, having been first duly sworn, testified as follows:

Direct Examination by Mr. Moore.

Q. 1. Please state your name, age, residence and occupation.

A. Harold W. Sweatt; 49; residence, Palm Beach, Florida; president, Minneapolis-Honeywell Regulator Company.

Q. 2. And how long have you been president?

A. I think since 1936.

Q. 3. And you heard Mr. Huff's testimony as to the predecessor?

A. Yes.

Q. 4. Of the Minneapolis-Honeywell when he was an officer, is that correct?

A. That is correct.

Q. 5. And you also heard his testimony as to the various officers of the Minneapolis-Honeywell who had the power to execute agreements and licenses for the corporation, is that correct?

1330 A. That is correct.

Q. 6. And also the officers named by him as being authorized to execute agreements?

A. That is correct.

Q. 7. You have been acquainted with the officers of The Mercoid Corporation and its predecessor in business, the Federal Gauge Company, for a great many years, have you not?

A. I have.

Q. 8. Of course, you are acquainted with the controversy between Minneapolis-Honeywell and Mercoid involving the Freeman patent?

A. I am.

Q. 9. And that is the controversy upon which you are now being questioned?

A. Yes.

Q. 10 The Freeman patent in question is the one that is referred to by you in your letter of November 28, 1932,

addressed to Mercoid Corporation, which has already been set up in the pleadings. (Handing a document to the witness.)

A. What is your question?

Q. 11. I ask you if this is the Freeman patent in this controversy?

1331 A. Yes.

Q. 12. I believe the pleadings set up that the Freeman patent was assigned to Minneapolis-Honeywell on April 14, 1932, and it was during that year that you called this patent to the attention of The Mercoid Corporation in this letter, was it not?

A. I called their attention on November 29, 1932.

Q. 13. You are familiar, are you not, with the licenses granted by Minneapolis referred to in Mr. Huff's testimony?

A. I am generally familiar with them.

Q. 14. And his statement that the price schedule A was attached to each was correct, was it not?

A. That is correct.

Q. 15. And that price schedule forms a part of each of these license agreements, does it not?

A. That is correct.

Q. 16. I believe that Mr. Huff testified that certain changes or amplifications had been made in those original agreements in accordance with his letter that he referred to of May 7th, and that is that they now incorporated these two paragraphs attached to that letter.

A. There were letters to these licensees covering this general subject. I cannot testify to more than that.

1332 Q. 17. These two paragraphs are apparently prepared for your signature. Do you know whether or not you signed those?

A. I imagine that I did.

Q. 18. The initials in the lower left hand corner would ordinarily indicate that you so dictated them?

A. That would so indicate.

Q. 19. You are an inventor yourself, are you not, Mr. Sweatt?

Mr. Freeman: We will concede that he is the patentee.

A. I suppose the answer would be yes.

Q. 20. You are the patentee named in letters patent 1,665,801 and 1,673,057, set up in the Mercoid pleadings, are you not?

A. I am.

Q. 21. Now, both of these patents include control system or control apparatus for a warm air furnace, do they not, or hot air heating of a room?

Mr. Freeman: You apparently have read these patents recently. Why don't you point out to Mr. Sweatt those parts you want him to refer to, and that would be helpful.

Q. 22. Both of these patents employ a circulating fan, do they not?

1333 A. Yes.

Q. 23. And there is a room thermostat?

A. That is correct.

Q. 24. For controlling the supply of the heating medium to the room?

A. That is correct.

Q. 25. And also for controlling the circulating fan?

A. I am not sure whether it does or not.

Q. 26. Are you familiar with the construction and operation of the Freeman patent that is in suit here?

A. Not very.

Q. 27. You call this Freeman patent a system patent, do you not?

A. I do not know the technical definition of a system patent, but it involves a number of different elements in each of the claims.

Q. 28. I show you your catalog of 1940 and call your attention to page 40. What is the last patent?

A. That is the Freeman patent.

Q. 29. And how is it described there? Just read that.

A. It shows the Freeman patent number and calls it a system patent and specifies the type of controls, broadly.

Q. 30. Each of these licenses contains a definition of combination furnace control and I believe they are

1334 identical in the printed forms as well as in the typewritten form. Are you familiar with that definition?

A. I have read the same.

Q. 31. I notice this definition starts:

"Used in this agreement the expression 'combination furnace control' shall mean a unitary structure, including at least a switching means for controlling not less than two circuits."

What is your understanding of a unitary structure?

Mr. Bair: That is objected to as calling for secondary evidence, and also calling for an opinion which is wholly immaterial to any issue in this case.

Mr. Moore: It is material in this case because this definition specifies the unitary structure and the patent in suit does not disclose a unitary structure, and I, therefore, feel that I am entitled to know the licensor's meaning of this expression.

Mr. Bair: The objection is repeated on the ground that the contract itself is the best evidence.

A. A unitary structure, I assume, means the elements, the combination furnace fan controls, are contained in a single unit.

Q. 32. In a single casing?

A. Yes.

1335 Q. 33. And you sell the unitary structure of that kind?

A. We do.

Q. 34. The definition continues after describing the two switches:

"The structure having permanent internal wiring connecting the switching means to terminals for the connection of external wires thereto."

From that I understand that there are binding posts within the casing to which the switches are connected, is that correct?

A. I believe that is correct.

Q. 35. Now, considering the remainder of that definition, am I to understand that this unitary structure with these binding posts is to be connected only in the manner specified in this definition, or does the Freeman patent cover any and all connections that might be made to these binding posts to control the operation of a fan and the operation of a heat generating medium?

Mr. Bair: That is objected to on the ground that the patent itself is the best evidence as to what it covers, and also on the ground that this witness does not purport to be a patent expert, and that the evidence called for is improper because it is expert testimony.

Mr. Moore: The evidence shows that the witness is an inventor, and is the inventor of a system which might
1336 be called analogous to the Freeman patent, and he should be able to answer that question without having expert knowledge.

A. My answer is I do not know.

Mr. Moore: All right.

Q. 36. Referring to Section 7, Price Condition, in Section (c), are you familiar with that? (Handing document to the witness.)

A. I have read it.

Q. 37. I note that it refers here to:

"No extras shall be included under any circumstances at a price for such extras at less than what said extras are sold at when sold with some other unit or control."

And then it makes an exception:

"Temperature indicating means to indicate the temperature and the thermal means of the 'combination furnace control' and a summer adjustment or locking means to provide fan operation only in the summer shall not be considered for the purpose of this agreement as an extra."

Do you know whether or not Minneapolis-Honeywell owns a patent on a summer adjustment or locking means to provide fan operation only in the summer?

A. I do not know.

Q. 38. Minneapolis either owned a license or owned an Edgecombe patent No. 1,138,854, which was reissued
1337 as Reissue 15,513, did they not? These two patents are set up in the pleadings of the Mercoid Corporation.

A. If my recollection is correct, the Honeywell Heating Specialties Company had a license under this which later went to Minneapolis-Honeywell Company.

Q. 39. That patent showed a summer switch, I believe. Could you tell that offhand?

A. Not without studying it.

Q. 40. The Edgecomb patent was granted in 1915, so it has expired now, has it not?

A. Yes.

Q. 41. In this price schedule, under "Manufacturer's Price," there are four items. The first item is, "The net minimum price for a combination furnace control shall be," and then it is specified.

A. That is right.

Q. 42. That is the combination furnace control such as is included in the definition in the license, is it not?

Mr. Bair: That is objected to for the same reason, as calling for secondary evidence, the license contract itself being the best evidence.

A. One of them, anyhow.

Q. 43. The next item is "The net minimum price for a combination furnace control including a summer
1338 switch." That is a summer switch that the license specifically excepts as being an extra, is it not?

Mr. Bair: The same objection.

A. I would assume so.

Q. 44. The third item is, "The net minimum price for a combination furnace control operable at two speeds shall be," and then the price.

Mr. Bair: The same objection.

A. I do not see any question in that.

Q. 45. Is a combination control operable at two speeds referred to anywhere in the license agreement that you know of, otherwise than the price schedule?

Mr. Bair: The same objection as last made.

A. I do not believe it is.

Q. 46. Does the Minneapolis-Honeywell own a patent on a combination furnace control operable at two speeds?

A. I do not know.

Q. 47. Is it not a fact that Minneapolis-Honeywell owns the Kriechbaum patent upon a combination furnace control, a patent operable at two speeds?

A. They owned the Kriechbaum patent.

Mr. Freeman: Number?

The Witness: No. 2,222,800, which you have shown me.

Q. 48. Is it not a fact that the application of this
1339 Kriechbaum patent became involved in an interference with a man by the name of Baker while in the Patent Office?

A. I do not know.

Q. 49. And the Baker patent later became patent No. 2,230,446?

A. I do not know.

Mr. Freeman: Who was the Baker patent issued to, Mr. Moore?

The Witness: It was assigned to the Cook Electric Company.

Q. 50. I show you here a certified copy of the assignment, or license agreement, rather, recorded in the United States Patent Office on May 22, 1939, in Liber K 179, page 323, which is an agreement between the Minneapolis-Honeywell Regulator Company and the Cook Electric Company. (Handing document to the witness.) Are you at all familiar with that?

A. I do not think I am.

Q. 51. That was executed by Charles B. Sweatt as vice president, I believe.

A. That is right.

Q. 52. As president, would you not be presumed to know of this agreement?

A. I very probably did at the time, but as to the

1340 details of it, I have no recollection.

Q. 53. Then we would have to ask Mr. Charles B. Sweatt as to details, would we not?

A. I would assume so.

Q. 54. This agreement relates to a pending application of Kriechbaum which bears the same serial number as the Kriechbaum patent I just showed you.

Mr. Freeman: That is objected to. The agreement speaks for itself, and if the serial number coincides with the serial number of the Kriechbaum patent, we will concede that they are one and the same.

Mr. Moore: And you also concede the Baker patent, which serial number corresponds with the serial number in this agreement?

Mr. Freeman: We are not doubting any written agreement, nor are we doubting any serial numbers or any patents issued by the United States.

Q. 55. I call your attention to paragraph 7 of this agreement.

Mr. Bair: This is the Cook agreement?

Mr. Moore: Yes. I will offer it in evidence.

Mr. Freeman: Are you asking him a question, Mr. Moore?

Mr. Moore: No, I am just referring to it and letting him read it.

1341 The Witness: I have read it.

Q. 56. This Section 7 of this agreement, executed March 31, 1939, reads as follows:

"The acceptance of a license this day by Cook Electric Company from Minneapolis-Honeywell Regulator Company under a Freeman patent No. 1,813,732, does not impliedly give any right to the latter company to grant sublicenses to its other licensees under said Freeman patent on two-speed operation as covered by said Baker application or any other application or patent owned or controlled by Cook Electric Company."

The acceptance of a license this day by Cook Electric Company from Minneapolis-Honeywell Regulator Company under the Freeman patent is the license first referred

to as being granted to the Cook Electric Company on the 31st day of March, 1939, is it not?

A. I would assume so. It could not be anything else.

Q. 57. My understanding of that section would be that this agreement prevents Minneapolis-Honeywell from granting sublicenses to its other licensees under the Freeman patent.

Mr. Freeman: That is objected to. The agreement speaks for itself, and as to what the understanding is of Mr. Moore, counsel for Mercoid, it is certainly immaterial in this case.

1342 Q. 58. Answer the question.

A. I do not know what your understanding is.

Q. 59. Well, what is your understanding?

A. My understanding would be that Minneapolis-Honeywell was not impliedly given any rights to grant such licenses under the other licenses under the Freeman patent.

Mr. Freeman: Will you please read that last answer?

(The answer was read as above recorded.)

Q. 60. I believe you stated that you did not know or were not acquainted with any of the negotiations leading up to this Cook agreement, either the original license or this one.

A. I do not want to state that because very possibly at the time I was. What I meant to say is that I do not recollect the details of this agreement, when you showed it to me.

Q. 61. Then you might have been present at conferences in which this interference was negotiated?

A. I do not believe I was, but I might have been familiar with the negotiations at the time.

Q. 62. Could you state whether or not Mr. Charles B. Sweatt, who signed both of these agreements for the company, would be more interested in these negotiations and have a better recollection?

1343 A. I would doubt it, because generally he is not very familiar with patent matters. I do not recollect how these came up.

Q. 63. You generally handle the patent matters?

A. Only from a broad policy standpoint.

Q. 64. The Mr. Fisher who is here today,—is he connected with any departments of Minneapolis-Honeywell?

A. He is.

Q. 65. What position does he hold?

A. He is head of our—he is patent attorney for the company.

Q. 66. Would he be present at negotiations of settlement of an interference?

A. Ordinarily, he would.

Q. 67. You stated that you are mainly interested in the policy of the company in connection with patent matters.

A. Yes.

Q. 68. It is the policy of the company to notify alleged infringers of any infringement of a patent, is it not?

A. Generally speaking.

Q. 69. And that you will grant them a license, in most instances, if they ask for it?

A. Not necessarily.

1344 Q. 70. Can you state whether or not between the time Minneapolis-Honeywell became the owner of this Freeman patent in 1932 and the time that the Cook Electric license was granted in 1939 you sent out notices of infringement to alleged infringers?

A. I believe we did.

Q. 71. Is it not a fact that you did notify the White Manufacturing Company, manufacturers of electrical supplies, in St. Paul, Minnesota, that they were infringing the Freeman patent in 1938?

A. My memory is not clear one way or the other.

Q. 72. Is the name White Manufacturing Company at all familiar to you?

A. Yes, I know the White Manufacturing Company.

Q. 73. And you might possibly have sent them a notice?

A. We might have sent them one.

Q. 74. They never took a license. The record shows that a license was never granted the White Manufacturing Company, does it not?

A. I do not know what is in the record, Mr. Moore.

Q. 75. Here are the five licenses. There were no other licenses granted under the Freeman patent than the ones that were presented?

A. I know of no other licenses.

1344 Q. 76. Referring to the Freeman patent in suit, that shows a room thermostat, does it not?

A. It does.

Q. 77. And the Minneapolis-Honeywell and their predecessors both manufactured room thermostats for a long time?

A. They did.

Q. 78. It also shows a warm air furnace control; indicated by 24, I think.

A. It shows a switch of the type which opens the circuit when a predetermined temperature has been exceeded.

Q. 79. That is called a warm air furnace control, is it not?

Mr. Bair: You mean that it is called that in the patent?

Mr. Moore: He just said what the patent stated there, and I am asking him if that is what they term a warm air furnace control.

A. It is used on a warm air furnace.

Q. 80. The Minneapolis-Honeywell made switches of that character long before the Freeman patent came out, did they not?

Mr. Freeman: Mr. Moore, do you mean furnace controls generally, or do you mean furnace controls of the
1346 kind specifically referred to in the Freeman patent?

Mr. Moore: Now, just a minute. The paragraph beginning line 6, page 2, of the Freeman patent reads as follows:

"The switch 24 is of the type which opens its circuit when a predetermined temperature has been exceeded. This temperature is so chosen that the circuit within the switch is opened when the furnace has been heated to such a point that further heating might prove dangerous."

And the furnace as disclosed in figure 2 is a warm air furnace. Now, the question is did Minneapolis-Honeywell make switches which answer this description long before the Freeman patent was granted?

A. I think they did.

Q. 81. This patent also shows a booster fan or a fan for increasing the circulation through the warm air furnace in figure 2, and it shows a dotted square indicated by the number 23. The paragraph beginning line 89, page 1 of the patent, states:

"The switch 23 is of a type which closes its circuit only when a predetermined temperature is exceeded. This temperature is so chosen that the circuit within the switch 23 is only completed when the furnace hood has been heated to a temperature greater than normal room temperature. Thus the fan 21 will not be operated if the furnace has not reached a temperature at which the air would be heated above room temperature. In other words, the fan 21 can never operate to force unheated air into the rooms
1347 to be heated while this control is in operation."

Now, do you know whether or not Minneapolis-

Honeywell put on the market controls which would answer that description of that switch?

A. I do not know.

Q. 82. Your catalogs would show it, would they not?

A. They should.

Q. 83. According to your last answer, you are not quite positive what controls Minneapolis-Honeywell makes, are you?

A. I cannot be familiar with the details of all of them.

Q. 84. Is there any official in your company who would know all the details of the various controls that you make?

A. I am afraid there would be no official that would know the details of all of them.

Q. 85. Is there any employe in your company who would particularly qualify as to that?

A. I doubt if there would be any one employe who would know the details of all of them.

Q. 86. I understood you to say you were only interested in the broad principles of policy in connection with your patents. Is there any official in your company whose responsibility is to know thoroughly the contents of
1348 your various licenses and agreements that are issued or granted by the company?

A. One official who would know all?

Q. 87. Yes.

A. I do not believe so.

Q. 88 Then you do not let your right hand know what your left hand is doing?

A. If you have too many details one person cannot know them all. That is all there is to that.

Q. 89. I understood you to say that Mr. Charles B. Sweatt as vice president would be more familiar than you in connection with the granting of the license to Cook and the exchange of licenses.

A. I did not say that.

Q. 90. Well, is there anybody in the company who would be more familiar than you are with those circumstances?

A. I think probably Mr. Fisher might be.

Q. 91. Then if we want any more detailed information we would have to ask Mr. Fisher?

A. I would think so.

Q. 92. Do you establish the policy for issuing licenses under these patents?

Mr. Freeman: You mean Mr. Sweatt personally?

Mr. Moore: He said he was mostly interested in
1349 the broad policies of the company in connection with patents.

A. I might or might not, Mr. Moore.

Q. 93. Would Mr. Fisher actually prepare the terms of these license agreements?

A. Mr. Fisher or other counsel that we might use.

Q. 94. And Mr. Freeman of Bair & Freeman might also?

A. Mr. Freeman might.

Q. 95. Does Mr. Bair also prepare licenses for the company, do you know, or does Mr. Freeman generally handle that for the firm?

A. I think Mr. Bair might have. I would not remember.

Q. 96. Then do you rely upon the advice of your attorneys in establishing policies on these licenses and the terms of the licenses?

A. That is what we hire them for.

Mr. Moore: I believe I have referred to certain documents which I would like to offer in evidence before I finish with this witness.

I offer a soft copy of the Baker patent in evidence as MERCOID EXHIBIT L.

(The patent was so marked.)

Mr. Freeman: It is objected to as immaterial to any issue or controversy here involved as between Mercoid and Minneapolis-Honeywell Regulator Company.

Form No. 44

MANUFACTURERS' PURCHASE CONTRACT

THE MERCOID CORPORATION

4201 BELMONT AVE. #4 CHICAGO, ILL.

2-16-38
Rec'd initial
order for
261 controls

THIS AGREEMENT, entered into between THE MERCOID CORPORATION, a Delaware corporation, hereinafter called the "COMPANY," and Herco Oil Burner Corp. of Lancaster, Pa. hereinafter called the "PURCHASER,"

Witnesseth:

WHEREAS the COMPANY is engaged in manufacturing automatic electric controls for heating, refrigerating, air conditioning and other apparatus, machinery and equipment, and

WHEREAS the PURCHASER is desirous of purchasing such controls for use in connection with products of the PURCHASER'S own manufacture,

NOW, THEREFORE, in consideration of the premises and of the mutual covenants hereinafter set forth the parties hereto agree as follows:

QUANTITY — Subject to the terms and provisions hereinafter contained, the COMPANY agrees to sell and the PURCHASER agrees to purchase, during the term of this agreement, ... units of the COMPANY'S automatic controls (each unit consisting of one of the controls listed herein), at the prices shown.

MISCELLANEOUS CONTROLS AND CONTROL EQUIPMENT — Miscellaneous automatic controls and control equipment of the COMPANY'S manufacture, not listed herein but shown in the COMPANY'S catalogue attached hereto, will be furnished at the catalogue list prices less the discounts shown on the manufacturers' discount sheet attached hereto. The list prices and discounts shall be subject to change at any time and from time to time, without notice. All orders for such miscellaneous controls and control equipment shall be subject to acceptance and approval by the COMPANY.

TERM OF AGREEMENT — This agreement shall become effective on the date of acceptance by the COMPANY and shall continue to and including December 31, 1938, unless sooner terminated as herein provided.

TERMS OF PAYMENT — All shipments shall be made f.o.b. the point of shipment with Factory Sight Draft attached to the Bill of Lading, the COMPANY to have the right to designate the point of shipment. If the draft is paid within 10 days from the date of the invoice a special cash discount of two per cent. (2%) will be allowed. If PURCHASER desires open account credit accommodation arrangements therefor should be made with the COMPANY'S credit department. If such arrangements are made invoices will be due net thirty days after the date of the invoice and a cash discount of two per cent. (2%) will be allowed if payment is made within 10 days from the invoice date. Credit terms and delivery of all equipment are subject to the COMPANY'S approval and the COMPANY shall have the right at all times to change or alter the terms of payment and to fix, change or alter such credit accommodations as may be extended to PURCHASER. Sales, excise and other taxes will be added to all prices and the amount of such taxes shall not be subject to discount. Invoices covering emergency shipments from a Branch Office of the COMPANY shall be subject to such discounts as are in effect at such Branch Office at the time of shipment, anything herein contained to the contrary notwithstanding.

USE OF CONTROLS BY PURCHASER — This agreement is made upon the understanding and condition that PURCHASER, who is a manufacturer, will not use or sell the controls or appliances purchased pursuant hereto except as a part of or in conjunction with machinery or equipment of PURCHASER'S own manufacture. If PURCHASER shall use or sell such controls or appliances otherwise than as above specified the COMPANY shall have the right to immediately terminate this agreement without notice.

IMPOSSIBILITY OF PERFORMANCE — The COMPANY agrees that it will, in good faith and to the best of its ability, promptly fill all orders received from PURCHASER and deliver the same to the carrier for shipment; provided, however, that the COMPANY shall not be obliged to fill orders in the event and to the extent that it may become impossible to do so because of war conditions, governmental regulations, strikes, labor disturbances, fires, floods, tornados, acts of God, mechanical breakdowns, shortages of raw materials, delays in receipt of raw materials and any other causes or conditions beyond the control of the COMPANY.

ASSIGNMENT OF CONTRACT — The PURCHASER shall not assign this contract or any interest therein without the written consent of the COMPANY.

PRICE REVISIONS — The COMPANY reserves the right to change and revise the prices listed herein upon thirty (30) days' written notice to PURCHASER. Revised prices shall apply to all orders received by the COMPANY after the expiration of the thirty (30) day notice period and also to all unfilled orders, including blanket orders, in the COMPANY'S possession at the expiration of such period. If the revised prices are not satisfactory to PURCHASER the PURCHASER may terminate this agreement by written notice received by the COMPANY within fifteen (15) days from the expiration of the aforesaid thirty (30) day period; provided, however, that such termination shall not affect completion of any orders received by the COMPANY prior to the COMPANY'S receipt of the PURCHASER'S notice of termination. During the aforesaid thirty (30) day price change notice period the PURCHASER may not order more than one-twelfth of the number of control units herein agreed to be purchased, or, at the COMPANY'S option, more than an equivalent number of control units shipped to PURCHASER during the same period of the previous year.

MERCOID EXHIBIT R-1

Form No. 44

CONTROL UNITS AND PRICES

		SINGLE SHIPMENT QUANTITIES		
	List Price	1 to 99 Assorted	100 to 249 Assorted	250 up Assorted
PRIMARY CONTROLS				
Type KMW Pyratherm	$23.00	$ 9.25	$ 9.00	$ 8.70
Type KMI Pyratherm	24.00	9.75	9.50	9.20
SPECIAL NOTE DEDUCT 50c EACH NET FROM THE RESPECTIVE ASSORTED QUANTITY PRICES BELOW WHEN ORDERING 10 OR MORE INSTRUMENTS OF ONE TYPE AND SPECIFICATION.				
THERMOSTATS				
Type H Sensatherm (Standard) 55-85°, with Thermometer	6.00	3.50	3.35	3.20
Type DNH Sensatherm, 55-85°, with Thermometer	16.00	8.50	8.50	8.50
Type HH Dual Sensatherm, 55-85°, with Thermometer	12.50	6.50	6.50	6.50
Type T-41 Timercoid and Transformer, 110-24 V., 60 cyc.	20.00	10.25	10.25	10.25
No. 855 Line Voltage Thermostat, with Thermometer	10.00	5.50	5.25	5.00
LIMIT CONTROLS				
Type DA-31 Steam Control, 0 to 14 lb.	6.00	3.35	3.25	3.25
Fig. 35 Risertherm (Clamp-on) Hot Water Control	6.00	3.35	3.25	3.25
Type 115W Immersatherm, 50 to 250° F.	8.00	4.35	4.25	4.25
Type DA-36 or DA-37 Immersion Hot Water	11.00	5.75	5.75	5.75
Type M-51 or M-53 Warm Air Fan or Limit	8.00	4.35	4.25	4.25
Type M-80 Combination Fan and Limit	14.00	7.50	7.25	7.00
Type DA-121 Combination Low Water and Pressure, 0 to 14 lb.	22.00	11.50	11.25	11.00
Type 123 Low Water Only, 30 lb. Max.	15.00	7.85	7.75	7.75

OTHER STANDARD OR ODD MODEL CONTROLS AT PREVAILING MANUFACTURERS PRICES

PRICES RELATING TO ALL CONTROLS ARE FOR 110 OR 220 VOLT, 60 CYCLE SPECIFICATIONS ONLY, UNLESS OTHERWISE SPECIFIED.

SPECIAL UNITS AND PRICES

GUARANTEE AND RETURNS

The COMPANY guarantees all control units and equipment manufactured by it and bearing its name or mark to be free from defects in workmanship and material. The COMPANY will, without charge, replace or repair within one year from date of shipment from the COMPANY'S factory any control unit or equipment that may be found to be defective upon inspection at the COMPANY'S factory. This guarantee does not obligate the COMPANY in any manner in cases where control units or equipment have been subjected to careless handling, improper application or faulty installation. In all cases the COMPANY'S liability on the guarantee herein expressed shall be limited to the repair or replacement of the defective control or equipment and in no event shall its liability extend to indirect or consequential damages. The guarantee herein expressed is made in lieu of all other warranties, guaranties, obligations, or liabilities expressed or implied by the COMPANY or its representatives. All statutory or implied warranties, other than of title, are hereby expressly negatived and excluded.

Returns must not be made without the COMPANY'S consent and in all cases the returned controls or equipment must be carefully handled, properly packed and shipped prepaid. If credit is allowed for returns the COMPANY will deduct ten per cent (10%) to cover handling and inspection charges and a further deduction will be made where recalibrating or refinishing is necessary. Specially made controls may not be returned for credit except at what the COMPANY determines is a fair value for the same.

PATENT WARRANTY

The COMPANY agrees that it will, at its own expense, defend any suit or proceeding that may be instituted against the PURCHASER based upon a claim that any apparatus of the COMPANY'S manufacture furnished by the COMPANY to the PURCHASER constitute an infringement of any Letters Patent of the United States, provided, that the PURCHASER shall not be in default hereunder and shall cause the COMPANY to be promptly notified in writing of such suit and shall give the COMPANY authority to defend such suit through the COMPANY'S counsel and shall furnish to the COMPANY all needed information and assistance for the defense of such suit. The COMPANY will pay all damages and costs awarded against PURCHASER in any suit defended by the COMPANY, provided notice of such suit and authority, information and assistance shall have been given to the COMPANY as aforesaid, and in the event the device or apparatus furnished by the COMPANY, or any part thereof, is held to constitute infringement and its use is enjoined the COMPANY will, at its own expense and at the COMPANY'S option, either: procure for the PURCHASER the right to continue using the infringing devices or apparatus; or replace the same with non-infringing devices or apparatus; or modify the infringing devices or apparatus so that they become non-infringing; or accept the return of the infringing devices or apparatus and refund the purchase price thereof. The foregoing constitutes the COMPANY'S only liability in connection with patent infringement by devices or apparatus furnished by the COMPANY.

Whenever the COMPANY deems it necessary for any reason whatsoever to discontinue the sale of any of the products of the COMPANY, the COMPANY agrees to give written notice to the PURCHASER to discontinue the sale of such products, and the PURCHASER agrees, upon receipt of such notice, to make no further sales or installations of any such products unless or until authorized so to do in writing by the COMPANY.

TERMINATION

In addition to any and all other provisions herein contained relating to termination or cancellation of this agreement, the following circumstances are hereby agreed to be and shall be deemed to be conclusive evidence of the breach of this agreement by either of the parties hereto, and in any of these events the other party hereto may, at its election, without prejudice to any other remedy it may have, terminate all further obligations on the part of such non-defaulting party made and to be performed under this agreement:

(a) The breach of or the failure to comply with any or all of the terms, covenants, conditions and provisions of this agreement, and a continuance of such breach for thirty or more days after receipt by the defaulting party of written notice thereof.

(b) The adjudicated bankruptcy, either voluntary or involuntary or the adjudicated insolvency of either party hereto, or the making of an assignment for the benefit of creditors or the appointment of a trustee or receiver for either of the parties hereto.

(c) The repudiation of this agreement, in whole or in part, by either party hereto.

FIELD SERVICE

The COMPANY will welcome the opportunity of cooperating with the PURCHASER in educating the PURCHASER'S factory personnel in the servicing and the proper installation of the COMPANY'S controls but the COMPANY does not agree or bind itself to render any such service.

The foregoing constitutes the entire agreement between the parties hereto and no change, alteration or modification of this agreement shall be binding unless reduced to writing and signed by the respective parties hereto. The validity, enforceability and interpretation of this agreement shall be determined and governed by the laws of the State of Illinois.

Weiss Oil Burner Corp	THE MERCOID CORPORATION
By J. E. Weiss	By
Pres Title	Title
DATE SUBMITTED: Feb 7-38	DATE ACCEPTED

MANUFACTURERS' PURCHASE CONTRACT

THE MERCOID CORPORATION

4201 BELMONT AVE. CHICAGO, ILL.

Date Submitted Feb. 11, 1939

THIS AGREEMENT, entered into between THE MERCOID CORPORATION, a Delaware corporation, hereinafter called the "COMPANY," and Herco Oil Burner Corp. of 10 W. Chestnut St. Lancaster, Pa. hereinafter called the "PURCHASER,"

Witnesseth:

WHEREAS the COMPANY is engaged in manufacturing automatic electric controls for heating, refrigerating, air conditioning and other apparatus, machinery and equipment, and

WHEREAS the PURCHASER is desirous of purchasing such controls for use in connection with products of the PURCHASER'S own manufacture,

NOW, THEREFORE, in consideration of the premises and of the mutual covenants hereinafter set forth the parties hereto agree as follows:

QUANTITY — Subject to the terms and provisions hereinafter contained, the COMPANY agrees to sell and the PURCHASER agrees to purchase, during the term of this agreement, their requirements of the COMPANY'S automatic controls. The special net prices extended herewith by the COMPANY are based on the PURCHASER'S 1939 control requirements estimated to be 15,000 units.

MISCELLANEOUS CONTROLS AND CONTROL EQUIPMENT — Miscellaneous automatic controls and control equipment of the COMPANY'S manufacture, not listed herein but shown in the COMPANY'S catalogue attached hereto, will be furnished at the catalogue list prices less the discounts shown on the manufacturers' discount sheet attached hereto. The list prices and discounts shall be subject to change at any time and from time to time, without notice. All orders for such miscellaneous controls and control equipment shall be subject to acceptance and approval by the COMPANY.

TERM OF AGREEMENT — This agreement shall become effective on the date of acceptance by the COMPANY and shall continue to and including December 31, 1939, unless sooner terminated as herein provided.

TERMS OF PAYMENT — All shipments shall be made f.o.b. the point of shipment with Factory Sight Draft attached to the Bill of Lading, the COMPANY to have the right to designate the point of shipment. If the draft is paid within 10 days from the date of the invoice a special cash discount of two per cent. (2%) will be allowed. If PURCHASER desires open account credit accommodation arrangements therefor should be made with the COMPANY'S credit department. If such arrangements are made invoices will be due net thirty days after the date of the invoice and a cash discount of two per cent. (2%) will be allowed if payment is made within 10 days from the invoice date. Credit terms and delivery of all equipment are subject to the COMPANY'S approval and the COMPANY shall have the right at all times to change or alter the terms of payment and to fix, change or alter such credit accommodations as may be extended to PURCHASER. Sales, excise and other taxes will be added to all prices and the amount of such taxes shall not be subject to discount. Invoices covering emergency shipments from a Branch Office of the COMPANY shall be subject to such discounts as are in effect at such Branch Office at the time of shipment, anything herein contained to the contrary notwithstanding.

USE OF CONTROLS BY PURCHASER — This agreement is made upon the understanding and condition that PURCHASER, who is a manufacturer, will not use or sell the controls or appliances purchased pursuant hereto except as a part of or in conjunction with machinery or equipment of PURCHASER'S own manufacture. If PURCHASER shall use or sell such controls or appliances otherwise than as above specified the COMPANY shall have the right to immediately terminate this agreement without notice.

IMPOSSIBILITY OF PERFORMANCE — The COMPANY agrees that it will, in good faith and to the best of its ability, promptly fill all orders received from PURCHASER and deliver the same to the carrier for shipment; provided, however, that the COMPANY shall not be obliged to fill orders in the event and to the extent that it may become impossible to do so because of war conditions, governmental regulations, strikes, labor disturbances, fires, floods, tornados, acts of God, mechanical breakdowns, shortages of raw materials, delays in receipt of raw materials and any other causes or conditions beyond the control of the COMPANY.

ASSIGNMENT OF CONTRACT — The PURCHASER shall not assign this contract or any interest therein without the written consent of the COMPANY.

PRICE REVISIONS — The COMPANY reserves the right to change and revise the prices listed herein upon thirty (30) days' written notice to PURCHASER. Revised prices shall apply to all orders received by the COMPANY after the expiration of the thirty (30) day notice period and also to all unfilled orders, including blanket orders, in the COMPANY'S possession at the expiration of such period. If the revised prices are not satisfactory to PURCHASER the PURCHASER may terminate this agreement by written notice received by the COMPANY within fifteen (15) days from the expiration of the aforesaid thirty (30) day period, provided, however, that such termination shall not affect completion of any orders received by the COMPANY prior to the COMPANY'S receipt of the PURCHASER'S notice of termination. During the aforesaid thirty (30) day price change notice period the PURCHASER may not order more than one-twelfth of the number of control units herein agreed to be purchased, or, at the COMPANY'S option, more than an equivalent number of control units shipped to PURCHASER during the same period of the previous year.

Form No. B 44

CONTROL UNITS AND PRICES

	List Price	Net Price
PRIMARY CONTROLS		
Type KMW Pyratherm—Constant Ignition Type	$19.00	$ 8.00
Type KMI Pyratherm—Intermittent Ignition Type	22.00	~~9.20~~ 7.00
Type RMI Pyratherm—Int. Ign., Recycling Type	22.00	~~9.20~~ [illegible]
THERMOSTATS		
LOW VOLTAGE TYPES		
Type H Sensatherm (Standard) 55-85°, with Thermometer	6.00	~~2.70~~ 2.30
Type DNH Day-Night Sensatherm, with Thermometer	17.00	8.50
Type HH Dual Sensatherm, with Thermometer	12.50	4.75
Type T-41 Timercoid and Transformer, 110-24V., 60 Cyc.	20.00	9.75
Type HBH Two-Stage Sensatherm, with Thermometer	11.00	5.10
Type HBR Two-Stage Sensatherm, with Thermometer	11.00	5.10
LINE VOLTAGE TYPES		
Type HA Sensatherm, with Thermometer, Max. 20 Watts	6.50	3.00
No. 855 Thermostat, with Thermometer, 10 Amp.-115 Volt	10.00	4.50
No. 855 Thermostat, without Thermometer, 10 Amp.-115 Volt	9.00	4.00
TRANSFORMER—RELAYS		
Type V2-3A, S.P.S.T. 10 Amp.-115 Volt	8.00	4.05
Type V2-105-590 with Built-in Summer Switch	13.00	6.00
LIMIT CONTROLS		
STEAM		
Type DA-31, 0 to 14 lb.	6.00	2.75
Type DA-31, Vapor-Vacuum, 10" vac. to 12 lb.	8.00	4.20
Type DA-31, 0 to 35 lb.	8.50	4.45
Type DA-31, 0 to 60 lb.	8.50	4.45
Type DA-31, 0 to 100 lb.	9.00	4.60
Type DA-31, 0 to 150 lb.	9.50	4.85
HOT WATER		
Fig. 35 Risertherm (Clamp-On Type), 110 to 200°F	6.00	2.75
Fig. 34 Risertherm, 140-230°F. (closes on rise in temp.)	7.00	3.25
Type 115W Immersatherm, 50 to 250° (opens on rise in temp.)	7.00	3.50
Type 115W-3 Immersatherm, 50 to 250° (closes on rise in temp.)	7.00	3.50
Type DA-36 Straight Stem Immersion, 110 to 200° or 135 to 235°	10.00	4.75
Type DA-37 Back Angle Stem Immersion, 110 to 200° or 135 to 235°	10.00	4.75
WARM AIR		
Type M-51 Limit Control	8.00	3.75
Type M-53 Fan Control	8.00	3.75
Type M-53 SW Fan Control with Summer Switch	8.50	4.00
*Type M-80 or M-80B Combination Fan and Limit Control	11.00	5.35
*Type M-82 or M-82B Combination Fan and Limit Control	12.00	5.85
*Type M-84 or M-84B Combination Fan and Limit Control	12.00	5.85
Type 116 Ductatherm, 50 to 300°	7.00	3.50

*FURNISHED STANDARD WITH BUILT-IN SUMMER SWITCH

CONTROL UNITS AND PRICES (CONT'D.)

	List Price	Net Price
LOW WATER CONTROLS		
Type DA-121 Combination Pressure and Low Water, 0 to 14 lb.	$20.00	$10.25
Type DA-121 Combination Pressure and Low Water, Range 0 to 14 lb. Complete with Quick Hook-Up	23.00	11.75
Type 123 Low Water Cut-Out, 30 lb. Max	14.00	7.00
Type 123 Low Water Cut-Out, 30 lb. Max., Complete with Quick Hook-Up Attachments	17.00	8.50

OTHER STANDARD OR ODD MODEL CONTROLS AT LIST PRICE LESS PREVAILING MANUFACTURERS DISCOUNTS. NET PRICE CONTROLS LISTED ABOVE MAY BE INCLUDED IN SINGLE SHIPMENT ORDERS TO OBTAIN QUANTITY DISCOUNTS ON THE LIST PRICE ITEMS SPECIFIED.

PRICES RELATING TO ALL CONTROLS ARE FOR STANDARD RANGES AS LISTED IN CATALOG AND FOR 115 VOLT 60 CYCLE SPECIFICATIONS ONLY, UNLESS OTHERWISE SPECIFIED.

SPECIAL UNITS AND PRICES

GUARANTEE AND RETURNS

The COMPANY guarantees all control units and equipment manufactured by it and bearing its name or mark to be free from defects in workmanship and material. The COMPANY will, without charge, replace or repair within one year from date of shipment from the COMPANY'S factory any control unit or equipment that may be found to be defective upon inspection at the COMPANY'S factory. This guarantee does not obligate the COMPANY in any manner in cases where control units or equipment have been subjected to careless handling, improper application or faulty installation. In all cases the COMPANY'S liability on the guarantee herein expressed shall be limited to the repair or replacement of the defective control or equipment and in no event shall its liability extend to indirect or consequential damages. The guarantee herein expressed is made in lieu of all other warranties, guaranties, obligations, or liabilities expressed or implied by the COMPANY or its representatives. All statutory or implied warranties, other than of title, are hereby expressly negatived and excluded.

Returns must not be made without the COMPANY'S consent and in all cases the returned controls or equipment must be carefully handled, properly packed and shipped prepaid. If credit is allowed for returns the COMPANY will deduct ten per cent. (10%) to cover handling and inspection charges and a further deduction will be made where recalibrating or refinishing is necessary. Specially made controls may not be returned for credit except at what the COMPANY determines is a fair value for the same.

PATENT WARRANTY

The COMPANY agrees that it will, at its own expense, defend any suit or proceeding that may be instituted against the PURCHASER based upon a claim that any apparatus of the COMPANY'S manufacture furnished by the COMPANY to the PURCHASER constitute an infringement of any Letters Patent of the United States, provided, that the PURCHASER shall not be in default hereunder and shall cause the COMPANY to be promptly notified in writing of such suit and shall give the COMPANY authority to defend such suit through the COMPANY'S counsel and shall furnish to the COMPANY all needed information and assistance for the defense of such suit. The COMPANY will pay all damages and costs awarded against PURCHASER in any suit defended by the COMPANY, provided notice of such suit and authority, information and assistance shall have been given to the COMPANY as aforesaid, and in the event the device or apparatus furnished by the COMPANY, or any part thereof, is held to constitute infringement and its use is enjoined the COMPANY will, at its own expense and at the COMPANY'S option, either: procure for the PURCHASER the right to continue using the infringing devices or apparatus; or replace the same with non-infringing devices or apparatus; or modify the infringing devices or apparatus so that they become non-infringing; or accept the return of the infringing devices or apparatus and refund the purchase price thereof. The foregoing constitutes the COMPANY'S only liability in connection with patent infringement by devices or apparatus furnished by the COMPANY.

Whenever the COMPANY deems it necessary for any reason whatsoever to discontinue the sale of any of the products of the COMPANY, the COMPANY agrees to give written notice to the PURCHASER to discontinue the sale of such products, and the PURCHASER agrees, upon receipt of such notice, to make no further sales or installations of any such products unless or until authorized so to do in writing by the COMPANY.

TERMINATION

In addition to any and all other provisions herein contained relating to termination or cancellation of this agreement, the following circumstances are hereby agreed to be and shall be deemed to be conclusive evidence of the breach of this agreement by either of the parties hereto, and in any of these events the other party hereto may, at its election, without prejudice to any other remedy it may have, terminate all further obligations on the part of such non-defaulting party made and to be performed under this agreement:

(a) The breach of or the failure to comply with any or all of the terms, covenants, conditions and provisions of this agreement, and a continuance of such breach for thirty or more days after receipt by the defaulting party of written notice thereof.

(b) The adjudicated bankruptcy, either voluntary or involuntary or the adjudicated insolvency of either party hereto, or the making of an assignment for the benefit of creditors or the appointment of a trustee or receiver for either of the parties hereto.

(c) The repudiation of this agreement, in whole or in part, by either party hereto.

FIELD SERVICE

The COMPANY will welcome the opportunity of cooperating with the PURCHASER in educating the PURCHASER'S factory personnel in the servicing and the proper installation of the COMPANY'S controls but the COMPANY does not agree or bind itself to render any such service.

The foregoing constitutes the entire agreement between the parties hereto and no change, alteration or modification of this agreement shall be binding unless reduced to writing and signed by the respective parties hereto. The validity, enforceability and interpretation of this agreement shall be determined and governed by the laws of the State of Illinois.

Purchaser

By

Title

THE MERCOID CORPORATION

By [signature]

Title

DATE ACCEPTED

MANUFACTURERS' PURCHASE CONTRACT

THE MERCOID CORPORATION

4201 BELMONT AVE. CHICAGO, ILL.

Date Submitted Jan. 27, 1940

THIS AGREEMENT, entered into between THE MERCOID CORPORATION, a Delaware corporation, hereinafter called the "COMPANY," and Merco Oil Burner Corporation of 109 W. Chestnut Street, Lancaster, Pennsylvania, hereinafter called the "PURCHASER."

Witnesseth:

WHEREAS the COMPANY is engaged in manufacturing automatic electric controls for heating, refrigerating, air conditioning and other apparatus, machinery and equipment, and

WHEREAS the PURCHASER is desirous of purchasing such controls for use in connection with products of the PURCHASER'S own manufacture,

NOW, THEREFORE, in consideration of the premises and of the mutual covenants hereinafter set forth the parties hereto agree as follows:

QUANTITY

Subject to the terms and provisions hereinafter contained, the COMPANY agrees to sell and the PURCHASER agrees to purchase, during the term of this agreement, their requirements of the COMPANY'S automatic controls. The special net prices extended herewith by the COMPANY are based on the PURCHASER'S 1940 control requirements estimated to be 15,000 units.

TERM OF AGREEMENT

This agreement shall become effective on the date of acceptance by the COMPANY and shall continue to and including December 31, 1940, unless sooner terminated as herein provided.

...S OF PAYMENT

All shipments shall be made f.o.b. the point of shipment with Factory Sight Draft attached to the Bill of Lading, the COMPANY to have the right to designate the point of shipment. If the draft is paid within 10 days from the date of the invoice a special cash discount of two per cent. (2%) will be allowed. If PURCHASER desires open account credit accommodation arrangements therefor should be made with the COMPANY'S credit department. If such arrangements are made invoices will be due net thirty days after the date of the invoice and a cash discount of two per cent. (2%) will be allowed if payment is made within 10 days from the invoice date. Credit terms and delivery of all equipment are subject to the COMPANY'S approval and the COMPANY shall have the right at all times to change or alter the terms of payment and to fix, change or alter such credit accommodations as may be extended to PURCHASER. Sales, excise and other taxes will be added to all prices and the amount of such taxes shall not be subject to discount. Invoices covering emergency shipments from a Branch Office of the COMPANY shall be subject to such discounts as are in effect at such Branch Office at the time of shipment, anything herein contained to the contrary notwithstanding.

USE OF CONTROLS BY PURCHASER

This agreement is made upon the understanding and condition that PURCHASER, who is a manufacturer, will not use or sell the controls or appliances purchased pursuant hereto except as a part of or in conjunction with machinery or equipment of PURCHASER'S own manufacture. If PURCHASER shall use or sell such controls or appliances otherwise than as above specified the COMPANY shall have the right to immediately terminate this agreement without notice.

IMPOSSIBILITY OF PERFORMANCE

The COMPANY agrees that it will, in good faith and to the best of its ability, promptly fill all orders received from PURCHASER and deliver the same to the carrier for shipment; provided, however, that the COMPANY shall not be obliged to fill orders in the event and to the extent that it may become impossible to do so because of war conditions, governmental regulations, strikes, labor disturbances, fires, floods, tornados, acts of God, mechanical breakdowns, shortages of raw materials, delays in receipt of raw materials and any other causes or conditions beyond the control of the COMPANY.

ASSIGNMENT OF CONTRACT

The PURCHASER shall not assign this contract or any interest therein without the written consent of the COMPANY.

...E REVISIONS

The COMPANY reserves the right to change and revise the prices listed herein upon thirty (30) days' written notice to PURCHASER. Revised prices shall apply to all orders received by the COMPANY after the expiration of the thirty (30) day notice period and also to all unfilled orders, including blanket orders, in the COMPANY'S possession at the expiration of such period. If the revised prices are not satisfactory to PURCHASER the PURCHASER may terminate this agreement by written notice received by the COMPANY within fifteen (15) days from the expiration of the aforesaid thirty (30) day period; provided, however, that such termination shall not affect completion of any orders received by the COMPANY prior to the COMPANY'S receipt of the PURCHASER'S notice of termination. During the aforesaid thirty (30) day price change notice period the PURCHASER may not order more than one-twelfth of the number of control units herein agreed to be purchased, or, at the COMPANY'S option, more than an equivalent number of control units shipped to PURCHASER during the same period of the previous year.

[illegible] H-2

Form No LB 3

CONTROL UNITS AND PRICES

	List Price	Net Price
PRIMARY CONTROLS		
Type JM Pyratherm—Constant Ignition Type	$19 00	$ 7.75
Type JMI Pyratherm—Intermittent Ignition Type	21 00	8.25
Type RMI Pyratherm—Int. Ign., Recycling Type	22 00	9.20
THERMOSTATS		
LOW VOLTAGE TYPES		
Type H Sensatherm (Standard) 55-85°, with Thermometer	6 00	2.50
Type DNH Day-Night Sensatherm, with Thermometer	17 00	8 50
Type HH Dual Sensatherm, with Thermometer	11 00	4 75
Type T-41 Timercoid and Transformer, 110-24V., 60 Cyc	21 50	9 75
*Type HBH Two Stage Sensatherm, with Thermometer	11 00	4 75
Type HBR Two Stage Sensatherm, with Thermometer	11 00	4 75
LINE VOLTAGE TYPES		
Type HA Sensatherm, with Thermometer, Max. 20 Watts	6 50	2 95
No. 855 Thermostat, with Thermometer, 10 Amp.-115 Volt	10 00	4 50
No. 855 Thermostat, without Thermometer, 10 Amp.-115 Volt	9 00	4 00
TRANSFORMER—RELAYS		
Type V2-3A, S.P.S.T. 10 Amp.-115 Volt	8 50	3 95
Type V2-105-590 with Built-in Summer Switch	15 00	7 00
LIMIT CONTROLS		
STEAM		
Type DA-31, 0 to 14 lb.	6 00	2 75
Type DA-31, Vapor-Vacuum, 10" vac. to 12 lb.	8 00	4 20
Type DA-31, 0 to 35 lb.	8 50	4 45
Type DA-31, 0 to 60 lb.	8 50	4 45
*Type DA-31, 0 to 100 lb.	9 00	4 60
Type DA-31, 0 to 150 lb.	9 50	4 85
HOT WATER		
Fig. 35 Risertherm (Clamp-On Type), 110 to 200°F.	6 00	2 75
Fig. 34 Risertherm, 140-230°F. (closes on rise in temp.)	6 50	3 00
Type 115W Immersatherm, 50 to 250° (opens on rise in temp.)	6 50	2 75
Type 115W-3 Immersatherm, 50 to 250° (closes on rise in temp.)	6 50	2 75
Type DA-36 Straight Stem Immersion, 110 to 200° or 135 to 235°	10 50	4 75
Type DA-37 Back Angle Stem Immersion, 110 to 200° or 135 to 235°	10 50	4 75
WARM AIR		
Type M-51 Limit Control	7 00	3 25
Type M-53 SW Fan Control with Summer Switch	7 50	3 40
*Type M-80 or M-80B Combination Fan and Limit Control	11 00	4 75
*Type M-82 or M-82B Combination Fan and Limit Control	12 00	5 10
*Type M-84 or M-84B Combination Fan and Limit Control	12 00	5 10
*Type M-88 or M-88B Combination Fan and Limit Control	12 00	5 10
Type 116 Ductatherm, 50 to 300°	PRICES ON APPLICATION	

*FURNISHED STANDARD WITH BUILT IN SUMMER SWITCH

CONTROL UNITS AND PRICES (CONT'D.)

LOW WATER CONTROLS	List Price	Net Price
Type DA-131Q Combination Pressure and Low Water, Range 0 to 10 lb., Complete with Quick Hook-Up	$23.00	$11.00
Type 123 Low Water Cut-Out, 30 lb. Max.	14.00	7.00
Type 123 Low Water Cut-Out, 30 lb. Max., Complete with Quick Hook-Up Attachments	17.00	8.50
Type 123 Low Water Cut-Out, 150 lb. Max.	16.00	8.00

OTHER STANDARD OR ODD MODEL CONTROLS AT LIST PRICE LESS 25-25% DISCOUNT.

PRICES RELATING TO ALL CONTROLS ARE FOR STANDARD RANGES AS LISTED IN CATALOG, AND FOR 115 VOLT, 60 CYCLE SPECIFICATIONS ONLY, UNLESS OTHERWISE SPECIFIED.

SPECIAL UNITS AND PRICES

GUARANTEE AND RETURNS

The COMPANY guarantees all control units and equipment manufactured by it and bearing its name or mark to be free from defects in workmanship and material. The COMPANY will, without charge, replace or repair within one year from date of shipment from the COMPANY'S factory any control unit or equipment that may be found to be defective upon inspection at the COMPANY'S factory. This guarantee does not obligate the COMPANY in any manner in cases where control units or equipment have been subjected to careless handling, improper application or faulty installation. In all cases the COMPANY'S liability on the guarantee herein expressed shall be limited to the repair or replacement of the defective control or equipment and in no event shall its liability extend to indirect or consequential damages. The guarantee herein expressed is made in lieu of all other warranties, guaranties, obligations, or liabilities expressed or implied by the COMPANY or its representatives. All statutory or implied warranties, other than of title, are hereby expressly negatived and excluded.

Returns must not be made without the COMPANY'S consent and in all cases the returned controls or equipment must be carefully handled, properly packed and shipped prepaid. If credit is allowed for returns the COMPANY will deduct ten per cent. (10%) to cover handling and inspection charges and a further deduction will be made where recalibrating or refinishing is necessary. Specially made controls may not be returned for credit except at what the COMPANY determines is a fair value for the same.

PATENT WARRANTY

The COMPANY agrees that it will, at its own expense, defend any suit or proceeding that may be instituted against the PURCHASER based upon a claim that any apparatus of the COMPANY'S manufacture furnished by the COMPANY to the PURCHASER constitute an infringement of any Letters Patent of the United States, provided, that the PURCHASER shall not be in default hereunder and shall cause the COMPANY to be promptly notified in writing of such suit and shall give the COMPANY authority to defend such suit through the COMPANY'S counsel and shall furnish to the COMPANY all needed information and assistance for the defense of such suit. The COMPANY will pay all damages and costs awarded against PURCHASER in any suit defended by the COMPANY, provided notice of such suit and authority, information and assistance shall have been given to the COMPANY as aforesaid, and in the event the device or apparatus furnished by the COMPANY, or any part thereof, is held to constitute infringement and its use is enjoined the COMPANY will, at its own expense and at the COMPANY'S option, either: procure for the PURCHASER the right to continue using the infringing devices or apparatus; or replace the same with non-infringing devices or apparatus; or modify the infringing devices or apparatus so that they become non-infringing; or accept the return of the infringing devices or apparatus and refund the purchase price thereof. The foregoing constitutes the COMPANY'S only liability in connection with patent infringement by devices or apparatus furnished by the COMPANY.

Whenever the COMPANY deems it necessary for any reason whatsoever to discontinue the sale of any of the products of the COMPANY, the COMPANY agrees to give written notice to the PURCHASER to discontinue the sale of such products, and the PURCHASER agrees, upon receipt of such notice, to make no further sales or installations of any such products unless or until authorized so to do in writing by the COMPANY.

TERMINATION

In addition to any and all other provisions herein contained relating to termination or cancellation of this agreement, the following circumstances are hereby agreed to be and shall be deemed to be conclusive evidence of the breach of this agreement by either of the parties hereto, and in any of these events the other party hereto may, at its election, without prejudice to any other remedy it may have, terminate all further obligations on the part of such non-defaulting party made and to be performed under this agreement:

(a) The breach of or the failure to comply with any or all of the terms, covenants, conditions and provisions of this agreement, and a continuance of such breach for thirty or more days after receipt by the defaulting party of written notice thereof.

(b) The adjudicated bankruptcy, either voluntary or involuntary or the adjudicated insolvency of either party hereto, or the making of an assignment for the benefit of creditors or the appointment of a trustee or receiver for either of the parties hereto.

(c) The repudiation of this agreement, in whole or in part, by either party hereto.

FIELD SERVICE

The COMPANY will welcome the opportunity of cooperating with the PURCHASER in educating the PURCHASER'S factory personnel in the servicing and the proper installation of the COMPANY'S controls but the COMPANY does not agree or bind itself to render any such service.

The foregoing constitutes the entire agreement between the parties hereto and no change, alteration or modification of this agreement shall be binding unless reduced to writing and signed by the respective parties hereto. The validity, enforceability and interpretation of this agreement shall be determined and governed by the laws of the State of Illinois.

________________ Purchaser

By ________________

________________ Title

THE MERCOID CORPORATION

By ________________

________________ Title

DATE ACCEPTED 2/11/[illegible]

ESTABLISHED 1885

MINNEAPOLIS-HONEYWELL REGULATOR CO.

MINNEAPOLIS, MINN.

Nov. 28, 1932.

Mercoid Corporation,
4201 Belmont Ave.,
Chicago, Ill.

Attention: Mr. L.H. Van Ness.

Gentlemen:-

At a meeting some time ago between Mr. Van Ness, Mr. Reed and myself, it was understood that I was to advise you of certain patents owned or controlled by our company which are being infringed by some of the devices that we understand you are building. Therefore, want to call your attention to these patents and ask that you investigate them and later talk the situation over.

Cyr	1,768,892
Phalen	1,847,033
Phalen	1,847,034
Phalen	1,847,037
	Re.18,361
	1,847,036.

All of the above patents in connection with your various types of Pyratherms.

In connection with bonnet mounted furnace controls:

1,736,129
1,782,530
1,847,033
1,847,037.

In connection with stack mounted stoker controls:

1,736,129
1,847,033.

In connection with your ceramic type switches, we believe certain claims of 1,774,108 would be of interest to you, and you are already familiar with the interference proceedings between Cramblet application v. McCabe patent 1,757,436.

In reference to stoker circuits, you are familiar with the fact that we are the sole licensees of the Cross patents and I will not go into detail on them at this time.

MERCOID EXHIBIT S

MINNEAPOLIS-HONEYWELL REGULATOR CO

Mercoid Corporation -2- Nov. 28, 1932.

In reference to your furnace fan circuits, we would call your attention to the Freeman patent No. 1,813,732.

On your type SM Pyratherm, we think you would be interested in studying our patent No. 1,764,344.

In connection with your type SV oil burner control, we very shortly are reissuing our patent No. 1,764,344, which will contain certain new claims which we think will be of interest to you.

In connection with your SM-V Pyratherm, we also want to call your attention to certain of the claims contained in above patent.

In connection with the type 855 room thermostat, certain claims contained in patents Nos. 1,704,370 and 1,736,129, which we believe are infringed.

The same holds true in connection with the 845 room thermostat and the #848 control.

I believe you were going to write me a similar letter after you had studied some of your patents in reference to our devices and will be pleased to have this at your convenience.

Yours very truly,

MINNEAPOLIS-HONEYWELL REGULATOR CO.

H. W. Sweatt

H. W. Sweatt, Vice-Pres. & Gen. Mgr.

HWS:JT

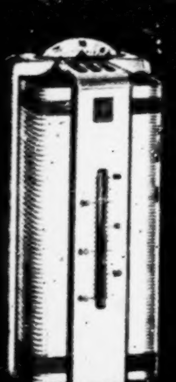
HONEYWELL

AUTOM

LIST * * * *

CONTR

CATALOG



1940

Patent Notice

Minneapolis-Honeywell Controls, Time-O-Stat Controls and Con-Tac-Tor Mercury Switches and National Regulator Controls are manufactured and sold under the following patents either owned by Minneapolis-Honeywell Regulator Company or under which Minneapolis-Honeywell Regulator Company is licensed. Other U.S. and foreign patents are pending.

No. Re 16,087	No. 1,694,053	No. 1,791,589	No. 1,875,387	No. 1,924,925	No. 2,008,749	No. 2,098,806	No. 2,144,587	No. 2,177,602
Re 16,140	1,694,107	1,792,101	1,875,388	1,925,455	2,008,770	2,099,687	2,145,146	2,178,825
Re 16,444	1,700,316	1,792,230	1,875,509	1,925,781	2,013,286	2,100,264	2,145,199	2,179,044
Re 17,993	1,703,534	1,795,149	1,875,510	1,926,880	2,017,368	2,101,548	2,145,791	2,179,700
Re 18,361	1,703,537	1,796,285	1,875,511	1,927,036	2,019,671	2,101,808	2,146,127	2,180,503
Re 18,503	1,704,008	1,796,511	1,875,589	1,927,846	2,019,945	2,102,324	2,146,604	2,180,675
Re 18,771	1,704,370	1,798,544	1,875,669	1,929,606	2,020,168	2,104,972	2,146,680	2,180,764
Re 19,091	1,704,371	1,800,412	1,876,044	1,931,238	2,021,407	2,105,686	2,146,681	2,180,800
Re 19,235	1,705,527	1,806,277	1,876,138	1,931,663	2,021,413	2,106,698	2,147,274	2,181,061
1,458,749	1,707,193	1,809,827	1,877,037	1,935,909	2,022,188	2,107,077	2,147,604	2,181,423
1,460,128	1,707,194	1,810,172	1,877,278	1,937,746	2,023,740	2,108,770	2,148,868	2,181,427
1,467,049*	1,707,195	1,813,732*	1,877,327	1,937,929	2,023,748	2,108,778	2,149,542	2,183,874
1,484,156	1,707,459	1,816,881	1,877,608	1,937,968	2,025,097	2,109,062	2,150,117	2,184,613
1,491,156	1,713,402	1,818,546	1,878,010	1,940,718	2,025,264	2,109,862	2,151,040	2,184,701
1,493,739	1,713,773	1,818,697	1,879,154	1,941,502	2,025,542	2,109,939	2,151,050	2,184,703
1,496,598	1,716,775	1,820,300	1,880,524	1,941,540	2,028,110	2,110,049	2,152,843	2,188,436
1,501,943	1,716,951	1,826,570	1,880,829	1,941,546	2,029,465	2,112,218	2,154,041	2,188,542
1,533,630	1,725,866	1,826,571	1,880,830	1,942,609	2,029,513	2,112,397	2,154,051	2,188,565
1,537,921*	1,725,876	1,826,572	1,880,831	1,943,988	2,029,615	2,114,704	2,154,511	2,188,635
1,543,418	1,727,308	1,826,993	1,880,832	1,946,598	2,032,656	2,114,961	2,154,523	2,188,775
1,543,445	1,727,735	1,827,071	1,880,871	1,946,903	2,036,868	2,114,965	2,154,644	2,188,806
1,544,342	1,730,828	1,827,072	1,881,637	1,949,210	2,037,911	2,116,606	2,154,656	2,188,865
1,558,277	1,730,829	1,827,340	1,881,964	1,951,663	2,038,087	2,116,801	2,155,356	2,188,877
1,559,186	1,730,830	1,828,553	1,882,341	1,953,425	2,039,910	2,116,802	2,155,964	Des 85,552
1,567,435	1,730,831	1,831,845	1,883,015	1,956,753	2,041,080	2,117,021	2,157,329	Des 86,681
1,569,474	1,732,174	1,832,482	1,883,146	1,957,035	2,041,363	2,117,514	2,158,059	Des 96,822
1,571,401	1,734,017	1,835,307	1,883,240	1,958,081	2,041,545	2,117,768	2,159,284	
1,572,495	1,736,129	1,835,974	1,883,241	1,958,093	2,041,821	2,118,866	2,159,503	
1,583,586	1,736,141	1,836,152	1,883,242	1,960,589	2,045,790	2,119,503	2,159,513	
1,585,629	1,738,190	1,839,630	1,883,243	1,961,252	2,048,162	2,119,944	2,159,617	
1,593,581	1,739,318	1,843,601	1,883,244	1,961,778	2,048,653	2,120,427	2,159,624	
1,598,874	1,744,189	1,844,936	1,883,245	1,961,802	2,052,536	2,120,803	2,159,951	
1,598,875	1,745,178	1,845,227	1,883,246	1,962,506	2,052,537	2,120,937	2,160,000	
1,598,876	1,745,640	1,847,033	1,883,247	1,962,820	2,052,918	2,120,938	2,160,042	
1,598,877	1,747,153	1,847,034	1,883,248	1,963,957	2,052,929	2,121,321	2,160,400	
1,599,173	1,749,828	1,847,035	1,883,957	1,966,106	2,052,947	2,122,887	2,161,248	
1,605,299	1,751,544	1,847,036	1,886,439	1,966,385	2,052,987	2,123,426	2,161,256	
1,607,392	1,752,149	1,847,037	1,893,238	1,969,136	2,054,331	2,123,283	2,161,892	
1,609,432	1,752,840	1,847,038	1,893,875	1,969,961	2,054,368	2,125,846	2,162,[illegible]37	
1,614,563	1,758,146*	1,847,880	1,899,254	1,969,967	2,055,033	2,126,182	2,166,602	
1,620,806	1,758,147*	1,848,087	1,899,744	1,969,968	2,059,635	2,126,384	2,167,227	
1,622,112	1,760,382	1,848,683	1,901,070	1,969,974	2,063,808	2,126,914	2,169,141	
1,625,796	1,763,093	1,850,448	1,902,173	1,970,987	2,064,193	2,127,472	2,169,166	
1,627,690	1,763,094	1,852,333	1,902,451	1,970,996	2,064,194	2,127,680	2,169,596	
1,631,404	1,764,346	1,853,194	1,902,452	1,972,291	2,064,231	2,129,472	2,170,072	
1,650,993	1,765,056	1,853,195	1,906,414	1,973,620	2,065,835	2,132,292	2,170,232	
1,651,629	1,765,297	1,853,196	1,906,771	1,974,960	2,066,841	2,132,322	2,170,310	
1,651,630	1,768,805	1,853,431	1,907,093	1,974,965	2,066,844	2,132,513	2,170,366	
1,652,524	1,768,892	1,854,207	1,908,009	1,976,705	2,068,413	2,134,940	7,170,497	
1,654,398	1,768,940	1,854,519	1,908,493	1,976,737	2,070,118	2,135,991	2,171,272	
1,654,840	1,768,941	1,854,540	1,908,494	1,979,690	2,072,025	2,136,336	2,171,273	
1,664,325	1,768,943	1,855,418	1,908,495	1,986,215	2,073,328	2,136,896	2,172,440	
1,665,801	1,768,949	1,855,741	1,910,721	1,986,216	2,073,346	2,137,550	2,172,487	
1,671,910	1,770,479	1,856,077	1,911,773	1,986,587	2,075,289	2,138,483	2,172,820	
1,673,057	1,773,817	1,856,586	1,912,791	1,988,809	2,076,518	2,138,760	2,173,331	
1,673,963	1,774,108	1,859,934	1,914,436	1,988,877	2,076,768	2,138,791	2,173,798	
1,675,131	1,774,109	1,861,046	1,916,814	1,989,278	2,080,718	2,138,792	2,173,799	
1,676,920	1,774,275	1,862,373	1,918,778	1,989,972	2,080,836	2,138,796	2,173,801	
1,676,922	1,779,143	1,862,383	1,918,794	1,990,216	2,081,091	2,140,451	2,173,809	
1,676,923	1,780,302	1,862,384	1,918,805	1,990,813	2,083,532	2,140,473	2,173,810	
1,678,202	1,780,312	1,866,641	1,919,337	1,991,691	2,083,612	2,140,486	2,174,910	
1,680,049	1,780,313	1,871,071	1,920,787	1,991,807	2,083,760	2,141,206	2,174,443	
1,680,263	1,780,980	1,872,147	1,920,888	1,993,262	2,086,037	2,141,244	2,175,720	
1,680,348	1,782,530	1,872,223	1,921,196	1,993,687	2,089,161	2,142,059	2,175,721	
1,683,408	1,783,474	1,872,880	1,922,201	1,997,599	2,089,826	2,143,076	2,176,009	
1,685,286	1,783,730	1,874,116	1,923,254	1,999,053	2,093,649	2,143,351	2,177,496	
1,688,121	1,786,741*	1,874,117	1,924,304	2,000,700	2,094,932	2,143,356	2,177,596	
1,690,881	1,787,700	1,874,611	1,924,908	2,003,834	2,098,323	2,143,569	2,177,597	

Canadian Patents

No. 238,347	[1924]
248,704	[1925]
255,926	[1925]
285,315	[1928]
292,948	[1929]
297,015	[1930]
305,083	[1930]
305,601	[1930]
324,363	[1932]
324,364	[1932]
324,365	[1932]
330,554	[1933]
333,959	[1933]
336,159	[1933]
336,160	[1933]
353,590	[1935]
354,695	[1935]
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376,096	[1938]
376,442	[1938]
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384,010	[1939]
386,107	[1939]

*The right to use the Systems protected by the following patents is only granted to the user by Minneapolis-Honeywell Regulator Company when the particular controls as shown below are purchased from Minneapolis-Honeywell Regulator Company and used in the Systems:

Patent No.	SYSTEM	CONTROLS
1,467,049	Diaphragm Gas Valve System	Any Main Fuel Valve or Safety Pilot
1,758,146	System of maintaining Stoker Fire	▲Stokerswitches
1,758,147	System of maintaining Stoker Fire	▲Holdfire Controls
1,786,741	Humidifying System	Humidity Responsive Controls
1,813,732	Forced Air Furnace Control System	Furnace Fan Controls

▲Trade Mark

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

MH

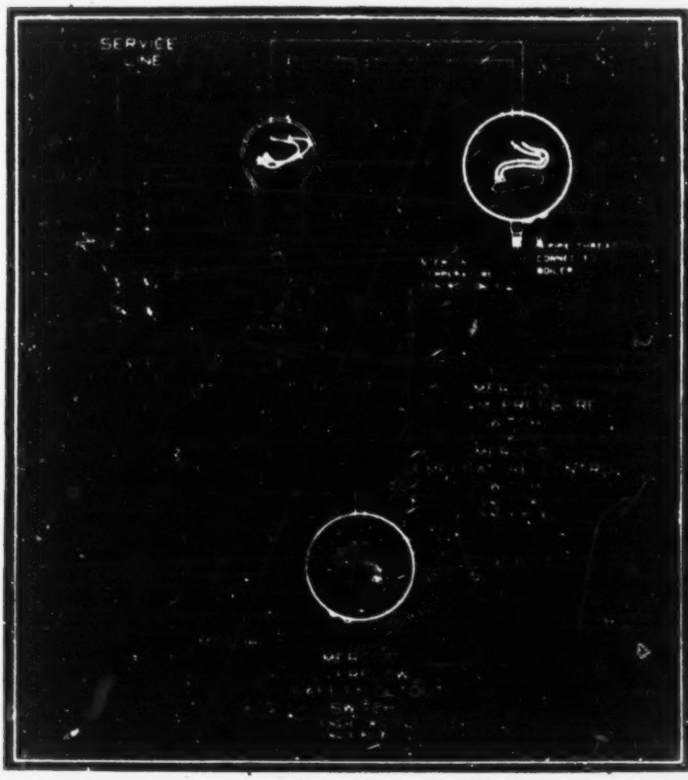
BULLETIN D

FEDERAL
MERCOID CONTROLS

Data Sheet No. 1 **April 1, 1924**

The accompanying diagrams illustrate a few of the many applications of the Mercoid Controls for temperature, pressure, etc., and show correct wiring diagrams. Mercoid Controls can be used for almost any work where it is desired to make and break an electric circuit according to temperature or pressure changes. Details of construction and operation of the Mercoid Thermostat are furnished in a special circular sent upon request.

Write us for additional information on Controls for special requirements, giving details of the the proposed application and statement of the work desired to be accomplished.



Typical Wiring Layout on Oil Burner

PATENTS PENDING

MERCOID EXHIBIT H

Mercoid Bulletin **E**

MERCOID SWITCH
FEDERAL
WARRANTED
CHICAGO MARSHALLTOWN

June
1924

FEDERAL MERCOID THERMOSTATS

Designed Especially for Automatic Heating Equipment

Contact is made within the Federal Mercoid sealed glass tube, containing inert gases and mercury.

Has no exposed conducting surfaces, eliminating corrosion, oxidation and open arc.

Federal Mercoid Tube is actuated by a sealed metal bellows, containing expansive liquids or gases.

Accurate and positive in operation.

Protected by brass cover having hard rubber finish.

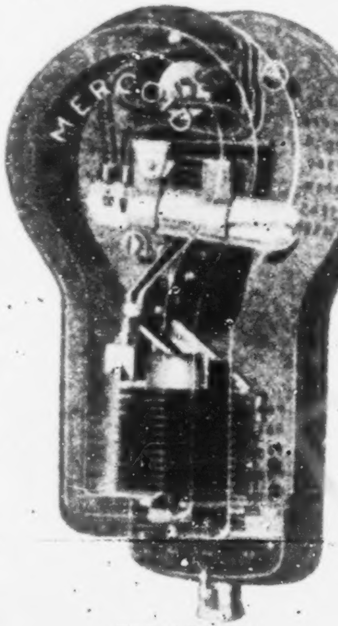


FIGURE 21

Federal Mercoid Thermostats will automatically control Motors of one horsepower or less, within guaranteed ratings, for normal working load of 10 amperes at 110 volts or 5 amperes at 220 volts (or their equivalents), *either A. C. or D. C.*, thereby eliminating the use of relays or remote controls. As a pilot switch, may be used to control any size motor.

Regularly furnished with standard scale 55° to 80° F., with a guaranteed operating differential of 2°.

Adjustable to open and close the circuit at any point within its range

List Prices for Standard Range Thermostats:

	Figure 21
Single Pole Type	$40.00 each
Two-circuit " (3-wire, or single pole and alarm)	45.40 "
Single Pole and Momentary Contact Type .	45.40 "
Two-pole Type	50.00 "
For Ranges Other Than Standard add to above lists	10.00 each

THE FEDERAL GAUGE COMPANY

564 WEST ADAMS STREET

CHICAGO, ILL., U. S. A.

PATENTS PENDING

MERCOID EXHIBIT V

FEDERAL MERCOID BOILER CONTROLS

Pressure Type

As safety limiting devices, Federal Mercoid Boiler Controls are positive, accurate and reliable.

May be used for circuit breaker on motors of one horsepower or less.

Regularly furnished with 1/4" male bottom connection.

FIGURE 31

Steam Switches must be siphoned (use an ordinary pig-tail or any other efficient siphon).

Furnished with semi-glass front and steel ring, or all metal cover.

BX or conduit connection furnished where specified.

Standard operating differential of 3 lbs. on pressures up to 10 lbs. and adjustable. Closer ranges where required. Pressures from 10 lbs. to 20 lbs. require a 5-lb. minimum operating differential, and pressures from 40 lbs. to 100 lbs. require a 10-lb. operating differential. Furnished for other pressures up to 400 lbs., requiring approximately 15% to 20% operating differential.

IMMERSION TYPE BOILER CONTROLS

Straight Stem Temperature Type

FIGURE 36

1/4" male conn. and 6" stem
or
1/2" male conn. and 3" stem

Standard Range, 140° to 180° F., adjustable up to 185° to 205° F. For lower temperature work the standard range is 140° to 160° F. adjustable up to 165° to 180° F. For Vapor or Steam Boiler Control the standard range is 200° to 214° F., adjustable up to 214° to 226° F.

Federal Mercoid Boiler Controls have a set operating differential but the high and low points may be changed by means of a small hex. nut on back of control.

Back Angle Stem Temperature Type

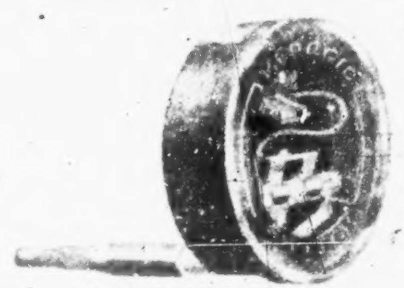


FIGURE 37

1/4" male conn. and 6" stem
or
1/2" male conn. and 3" stem

For List Prices on Above See Page Three of This Bulletin

*PATENTS PENDING

MERCOID LEVER ARM TYPE CONTROLS

Counterbalanced Type

FIGURE 40

For Maintaining fluid levels

Lever Arm Overflow Type

(Top or Bottom Mounting)

FIGURE 46

For final safety on overflow also on Vapor Heating Systems, close regulations may be obtained with this type of control, when used in connection with chain and weights on lever arm of Boiler Regulator

Made to open or close circuit, with lever arm in up or down position.

Lever Arm Type, Figure 46, may be used as a sump switch or in connection with a cellar drainer. Positive, accurate and reliable, will automatically control directly, motors of one-horse-power or less, within guaranteed rating, for normal working load of 10 amperes at 110 volts or 5 amperes at 220 volts (or their equivalents), *either A. C. or D.C.*, thereby eliminating the use of relays or remote controls. As a pilot switch may be used to control any size motor.

List Prices

	Fig. 41 Each	Fig. 36 Each	Fig. 37 Each	Fig. 40 Each	Fig. 46 Each
Single Pole Type	$27.00	$30.00	$32.00	$22.00	$17.00
Two-circuit (3-wire or S. P. and alarm)	33.00	36.00	38.00	28.00	23.00
Single Pole and Momentary Contact	33.00	36.00	38.00	28.00	23.00
Two-Pole Type	37.00	40.00	42.00	32.00	27.00
For Ranges other than Standard add	5.00	10.00	10.00		

PATENTS PENDING

MERCOID SWITCH
FEDERAL
WARRANTED
CHICAGO MARSHALLTOWN
TRADE MARK

FEDERAL MERCOID FURNACE CONTROL

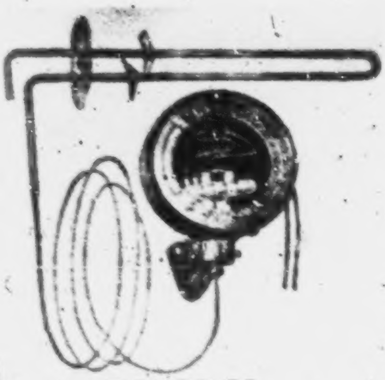


FIGURE 50

For automatic control on warm air furnaces.

Acts as safety device to prevent overheating of furnace.

Standard Range 250° to 300° F. Range may be adjusted by sliding loaded stem in or out of furnace dome, or by standard adjustment on back.

Furnished with bronze stem, charged with an expansive liquid, operating on the same principle as the Federal Mercoid Hot Water Boiler Control.

Equipped with bracket for wall fastening.

The Federal Mercoid Furnace Control has the same electrical rating as other Mercoid instruments, making relays unnecessary for currents up to 10 amperes at 110 volts or its equivalents.

List Prices

	Each
Single Pole	$40.00
Two-circuit (3-wire or single pole and alarm)	46.00
Single Pole and Momentary Contact	46.00
Two-pole	50.00

FEDERAL MERCOID SWITCHES

Types illustrated below are furnished for other than Pressure, Vacuum or Thermostatic purposes

Two Circuit

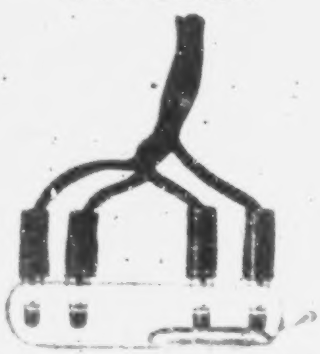


FIGURE 2

Single Circuit

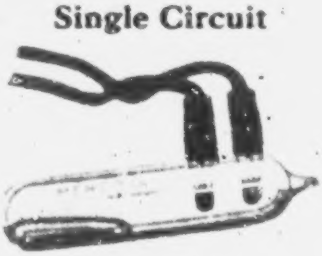


FIGURE 3

Relay Type

FIGURE 4

LIST PRICES

Figure 2	$8.70 each
Figure 3	6.35 each
Figure 4	3.75 each

PATENTS PENDING

ANNOUNCEMENT

THIS catalog is issued in the new name of The Mercoid Corporation. The change is made to conveniently provide for the continual growth taking place in this organization. The founders of The Federal Gauge Company, (which is still the parent Company) have also recently secured the controlling interest in the Arcless Contact Company. There is no change in the entire personnel of the Company. The additional facilities and advantages will afford greater service to old and new customers.

Address correspondence to The Mercoid Corporation,
General Offices 564 West Adams Street, Chicago, Ill.

MERCOID *System of* DIRECT CONTROL

Catalog
Number
"H" - 3
1928

COMPLETE AUTOMATIC CONTROLS for HEATING EQUIPMENT

THE MERCOID CORPORATION
564 WEST ADAMS STREET
Chicago, Illinois, U.S.A.

25 Church Street
New York, N. Y.

The Monadnock,
San Francisco, Calif.

Cable Address "MERCOID" Chicago

MERCOID EXHIBIT X

The Mercoid Risertherm

Surface Type Control with Mercoid Thermal Element

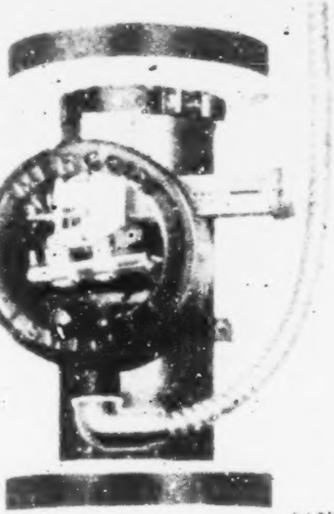


Figure 35 Risertherm mounted on vertical pipe.

Simple to install.

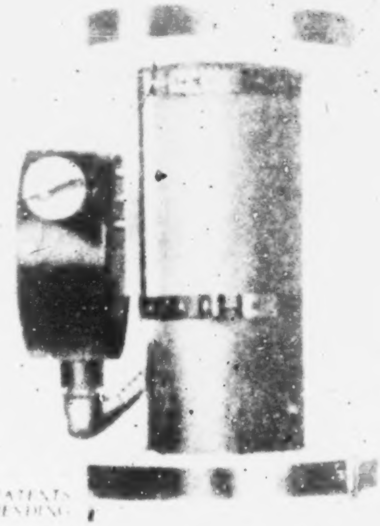
External temperature adjustment

One type fits either horizontal or vertical pipe

Clamp feature locks instrument securely in place.

Fits any pipe or hot water tank

Positive Snap Action



Side view of Risertherm mounted on vertical pipe

MERCOID FIGURE 35 RISERTHERM

THE Risertherm is designed to be clamped on the risers of hot water heating system, or the surfaces of hot water tanks or pipes to regulate the temperature within.

It has many advantageous features not found in any other instrument of this type.

This type of control will not give the same coordinate performance under all weather conditions as does the immersion type (see pages 849). However, its special features insure more positive and accurate performance under all conditions than is to be expected generally in limiting devices of the surface type.

Simplicity of installation and adjustment are among its outstanding features.

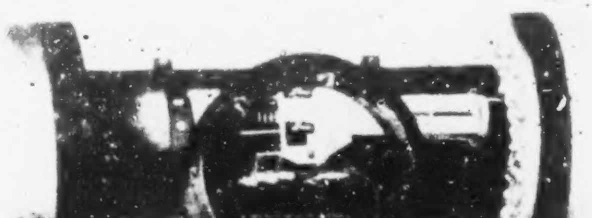


Figure 35L Risertherm mounted on horizontal pipe.

MERCOID FIGURE 35L RISERTHERM

Identical in type and design with Figure 35, except for the two-circuit arrangement, for 3 wire or low voltage requirements. Made with special terminal block clearly marked for such installations.

Standard range is between 110° F. and 210° F. A special range from 140° F. to 230° F. is available when specified. The operating differential of both ranges is approximately 10° F. to 30° F. according to the size of pipe and the conditions of the installation. Additional adjustment is provided within the case to increase the differential where desirable.

The clamping feature of the Risertherm is adjustable to any size pipe and it may be applied to the surface of large diameter tanks by the use of extra length strips. Five feet of perforated strip is regularly supplied which is cut to the necessary length by the installer.

Particular attention is called to the fact that the locking feature of the clamp is designed to maintain accurate and secure location of the instrument. The control cannot be moved without also moving the entire clamp. When the clamp is tightened, it is practically impossible to move the instrument around on the pipe. This prevents accidental disarrangement which might interfere with proper operation in service. Changing the vertical position of the Risertherm does not change the cut in or cut out points. This is a distinctive feature of all Mercoid Controls.

MERCOID System of DIRECT CONTROL

Mercoid Combination Controls

For Low Water and Pressure

TYPES AVAILABLE UP TO 300 LBS

PATENTS ISSUED
[illegible]
OTHERS PENDING

THE Mercoid Low Water and Pressure Control is designed, primarily, for the protection of automatically fired steam boilers, but has various other fields of application. Boilers to which fuel is supplied continuously offer the hazard of firing into dry boilers or building up excess pressure, against which this instrument is designed to guard.

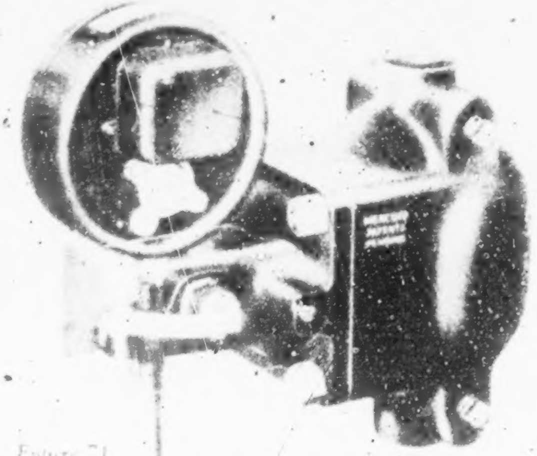


Figure 71

MERCOID FIGURE 71

For Complete Protection

For use on boilers for pressures, as specified, up to 300 lbs. Arranged to break burner motor circuit when water level falls or when steam pressure rises to a predetermined point. Regularly supplied fully automatic, but is made semi-automatic with manual reset where so specified.

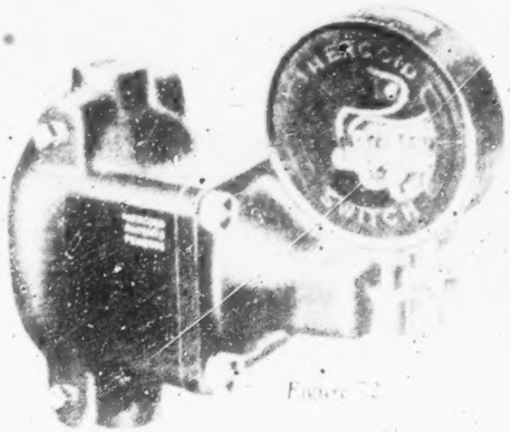


Figure 72

MERCOID FIGURE 72

Low Water Control

Mercoid low water control only, for use on boilers for pressures, as specified, up to 300 lbs. Regularly supplied fully automatic, but is made semi-automatic, with manual reset where so specified.

Where used for control of motor driven feed pump, may be arranged to close circuit at low water level.

Available for pressures above 300 lbs. at special prices.

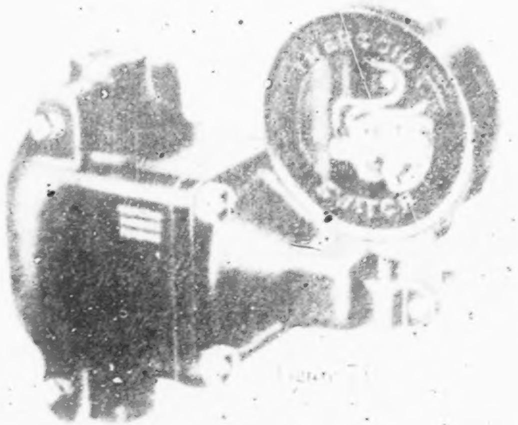


Figure 73

MERCOID FIGURE 73

For Vapor or Vapor Vacuum

The Figure 73 control has been designed for use where diaphragm regulators are available on the boiler, also for vapor or vapor vacuum systems having standard equipment floats or diaphragms. This unit may be attached on such installations and positive operation assured, especially where very close pressure regulation is essential.

THE MERCOID CORPORATION

Mercoid Furnace Controls

For Warm Air Furnaces

A POSITIVE SAFETY DEVICE TO PREVENT OVERHEATING

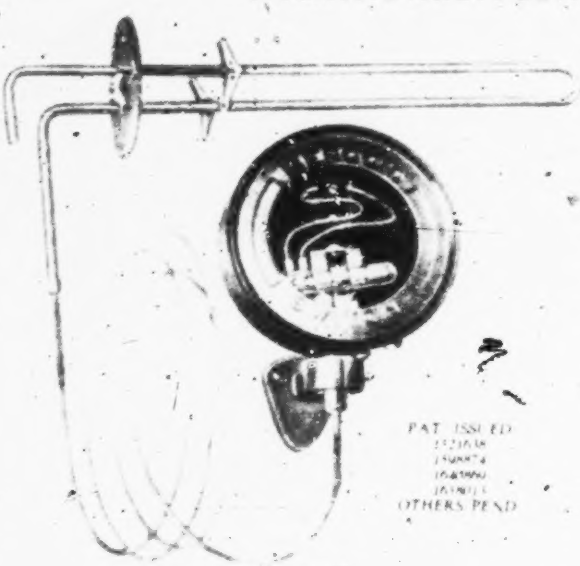


Figure 50

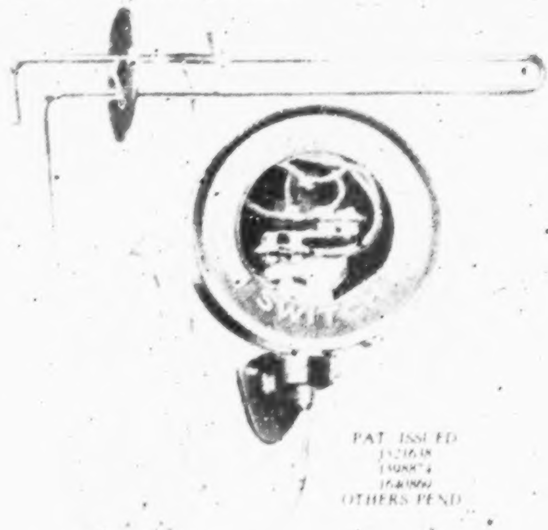


Figure 50-L 3-Wire

FIGURE 50

Will handle currents up to 10 amperes at 110 volts or 5 amperes at 220 volts, A. C. or D. C.

FIGURE 50-A

Equipped with Fig. 17 Mercoid Tube. For applications where the current requirements do not exceed 3 amperes at 110 volts, A. C. or D. C.

FIGURE 50-L (3 Wire)

Designed for 3-Wire or low voltage installations. Furnished with one each, red, white and blue binding posts. Will handle currents not in excess of 1 ampere at 110 volts, A. C. or D. C.

THE instruments shown above are designed for operation on warm air furnaces that are equipped with motor-driven units. The bronze remote stem, which is charged with an expansive liquid, is intended for installation in the furnace hood above the dome, while the instrument proper may be mounted conveniently on a wall, by means of the bracket provided therefor, as shown in the illustration. When so installed this control operates as a positive safety device to prevent over-heating. Standard range 250° F. to 300° F., opening the electric circuit at the high point and restoring it on a 50° drop in the temperature in the furnace dome. The range may be adjusted by simply sliding the stem in or out of the furnace hood, also by the standard adjustment on the back of the case. Regularly furnished fully automatic or semi-automatic when specified.

Orders should specify whether circuit is to close on rise or fall in temperature.

Furnace Fan Control for automatic control of booster fans on warm-air furnaces.

Standard range is 190° F. to 140° F., cutting in at high point to start the fan motor and cutting out when the dome temperature drops to the low point.

LIST PRICES

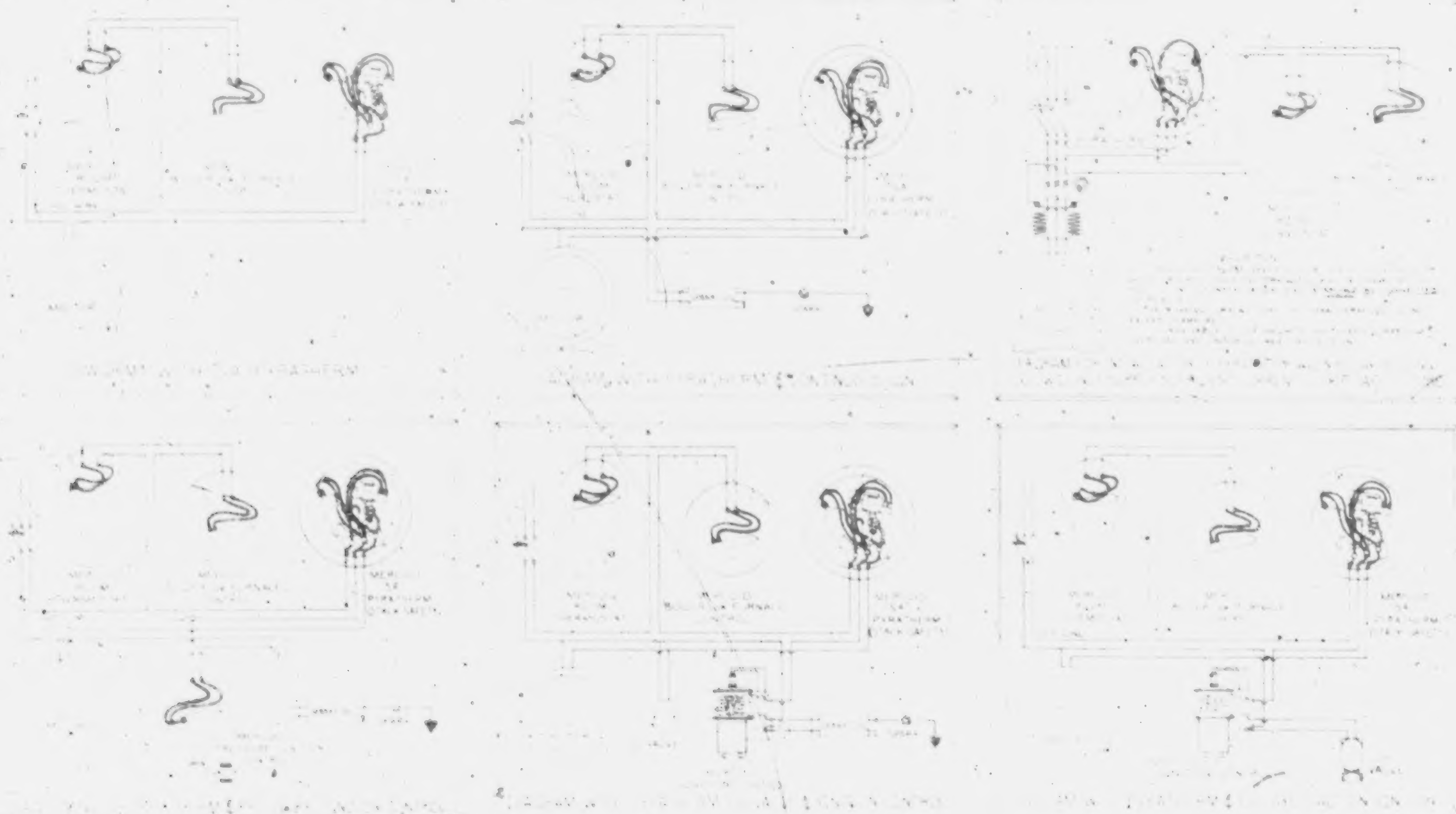
Fig. 50, $27.00 Fig. 50A, $24.00 Fig. 50L, $27.00

For 2 Pole add to list 6.00

Shipping Weight 6 lbs. 11 oz.

TYPICAL MERCOID WIRING DIAGRAMS

THE simplicity of the Mercoid system of 2-wire direct control is fully recognized. There are no confusing or intricate wiring installations to be made. The hazards and expense of improper hookup are avoided.



The hookups shown above are typical of the usual oil burner installations in connection with the Pyratherm Type SA.

AUTOMATIC CONTROLS FOR DOMESTIC AND INDUSTRIAL HEATING EQUIPMENT

MERCOID

CATALOG

No H5

1 9 2 9

REVISED EDITION

Combined Industries
The Federal Gauge Company
Arcless Contact Company

THE MERCOID CORPORATION
564 WEST ADAMS STREET
Chicago, Illinois, U S A

25 Church Street
New York, N. Y.

1129 Folsom Street
San Francisco, Calif.

Cable Address "MERCOID" Chicago

MERCOID EXHIBIT Y

The Mercoid Pressure Control

For Steam Boilers (Cont'd)

Figure 31-L

PAT. ISSUED [illegible] OTHERS PEND.

FIGURE 31-L

for 3-wire or low voltage

Designed for 3-wire or low voltage requirements, with one each, red, white and blue binding posts will handle currents not in excess of 1 ampere at 110 volts, A. C. or D. C.

For automatic oil burner installations requiring a 3-wire or low voltage hookup.

ADJUSTMENTS

All types have a simple adjustment for raising or lowering the cut-in and cut-out points.

1. *Improved type outlet box with outside screws, for making quick electrical connections. (Not used on low voltage types.)*
2. *Knurled hand reset button on both fully automotic and semi-automatic types of instruments.*
3. *Hand adjustment for raising or lowering the boiler control setting.*

Figure 31

Standard range 1 to 4 lbs. adjustable 7 to 10 lbs.

Available ranges other than standard:

Setting	Adjustable
0 to 2 lbs.	1 to 3 lbs.
½ to 3 lbs.	2 to 4½ lbs.
5 to 8 lbs.	9 to 12 lbs.
5 to 10 lbs.	10 to 15 lbs.

Where furnished for pressures above 15 lbs. and up to 25 lbs. the minimum operating differential is 5 lbs. Pressures above 25 lbs. and not exceeding 90 lbs. require a minimum operating differential of 10 lbs.

For pressures from 90 lbs. to 150 lbs. an operating differential of from 15 lbs. to 20 lbs. is the minimum.

Pressures from 150 lbs. to 300 lbs. require a 25 lb. to 30 lb. minimum operating differential. Higher pressures available.

LIST PRICES

	[illegible]	Maximum Operating Pressure [illegible]	Maximum Operating Pressure [illegible]	Maximum Operating Pressure 90 lbs. to 300 lbs.
Figure 31 Single Pole	$20.00	$22.00	$24.00	$30.00
Figure 31-A Single Pole	17.00	19.00	21.00	27.00
Figure 31-L (3-wire)	20.00	22.00	24.00	30.00
Figure 31 Two Pole for two circuit	26.00	28.00	30.00	36.00

[illegible] maximum operating pressures [illegible] differentials or the difference between the cut-in and cut-out points. In ordering pressure [illegible] cut-in and cut-out points required.

Double Adjustment Type shown on page 20.

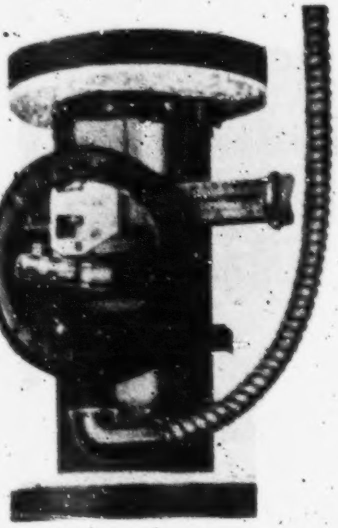
Case diameter, 5¼", height overall, 7⅛", depth 3¼" with outlet box.

Shipping Weight 4 lbs. 14 oz.

THE MERCOID CORPORATION

The Mercoid Risertherm

Surface Type Control with Mercoid Thermal Element

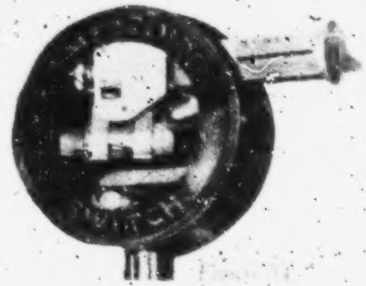


Simple to install.

External temperature adjustment. The same type fits either horizontal or vertical pipe.

Clamp feature locks instrument securely in place.

Fits any pipe or hot water tank. Positive Snap Action.



PAT. ISSUED
1598874
1640869
1658013
1687842
1705989
OTHERS PEND

Figure 35 Risertherm mounted on vertical pipe.

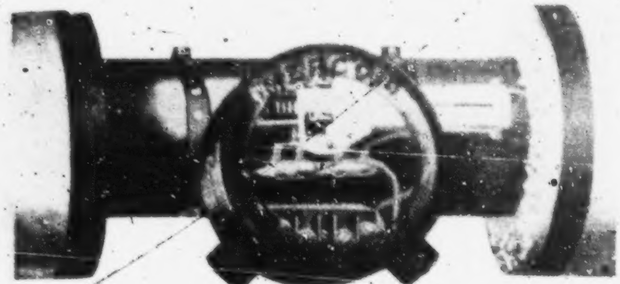


Figure 35L Risertherm mounted on horizontal pipe.

THE Risertherm is a temperature limiting device designed to be clamped on the risers of hot-water heating systems or the surface of hot water tanks or pipes to regulate the temperature within.

Simplicity of installation and ease of adjustment are outstanding features of the Risertherm.

The same instrument may be quickly installed in either a vertical or horizontal position. This feature is a convenience to the installer and economizes on stock.

The Risertherm is sturdy in construction and built for enduring service. Every precaution has been taken to insure safe and dependable performance. If the thermal element should be removed or injured in any way, the circuit will automatically open and stop the equipment.

The clamping arrangement, properly installed, securely holds the instrument in a permanent position, removes the danger of slipping on the pipe or tank and prevents accidental disarrangement.

For vapor-vacuum heating systems, Fig. 37 is recommended, instead of the Risertherm. See page 8.

FIGURE 34

For Dual Control of Unit Heaters

This instrument is designed to close the circuit when the temperature rises to a predetermined point, opening the circuit when the temperature falls. Used in connection with a thermostat for dual control of unit heaters to prevent operation of the fan until the coils are heated, insuring economical operation.

FIGURE 35

This instrument is designed to open the circuit when the temperature rises to a predetermined point, closing the circuit when the temperature drops. Used as a limiting device in connection with automatic hot water heating equipment.

Figs. 34 and 35 instruments are regularly supplied with Fig. 3 tube, handling currents up to 10 Amp. at 110 Volts and 5 Amp. at 220 Volts, A. C. or D. C.

Figs. 34-A and 35-A are identical in design with Figs. 34 and 35 respectively, except that they are regularly supplied with Fig. 17 tube for handling currents up to 3 Amp. at 110 V. and 1½ Amp. at 220 Volts, A. C. or D. C.

Figs. 34-L and 35-L are also identical with Figs. 34 and 35 respectively, except that they are supplied with two circuit arrangement for 3-wire or low voltage requirements. Made with special terminal block clearly marked for such installations.

STANDARD RANGE

Standard range: 110° F. to 200° F. A special range, 140° F. to 230° F. is available for unit heater application. The operating differential of both ranges is approximately 6° F. to 24° F. according to the size of pipe and the conditions of the installation.

Mercoid Furnace Controls

A New Design in Furnace Controls Employing a Thermostatic Metal Coil

For Warm Air Furnaces and Booster Fans

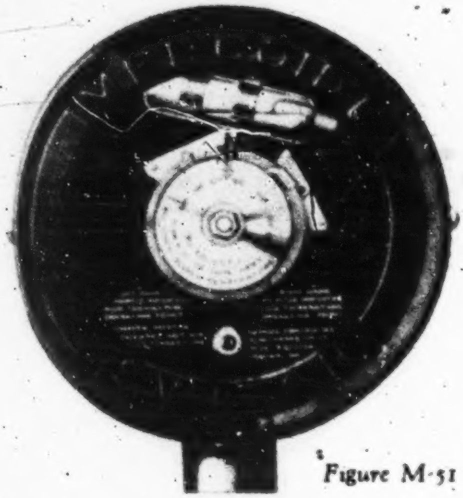


Figure M-51

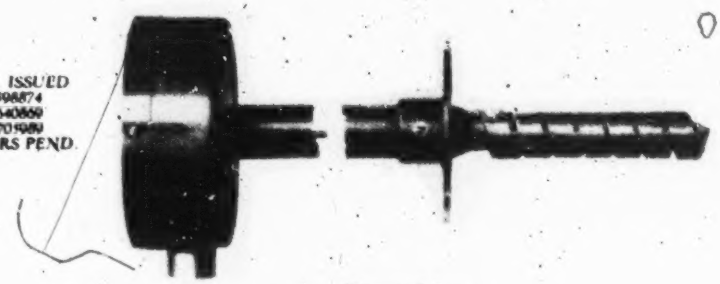


Figure M-51
Showing side view of instrument

This control is used to prevent the overheating of warm air furnaces. Used also for booster fan control, to turn on fan when the furnace temperature has reached a predetermined degree shut off when the furnace has cooled to a predetermined temperature. This instrument has some exclusive features. It indicates the temperature in the furnace duct so that one may see at a glance what heat the furnace is generating. This information is useful in determining the amount of heat required for any desired conditions.

The case has a glass front, permitting the temperature dial to be plainly visible.

An adjustable differential is provided.

This control is easy to install, accurate and positive in its operation, and will give long and reliable service.

When ordering specify if it is to be used as a safety furnace control or for booster fan application. The same control can be used for either purpose by simply reversing the Mercoid tube. For furnace control, the mercury switch is placed so that the contacts or electrodes in the switch are to the left side, while for booster fan installation the Mercoid switch is placed with the electrodes to the right side.

The switch tube is shellaced to the clamp at the factory, and if an outside change is made it should again be shellaced so that it will remain in a fixed position.

No relay or starting switch is necessary where the normal working loads do not exceed 10 amperes at 110 volts or 5 amperes at 220 volts A. C. or D. C.

Dimensions: 16½" long over-all, diameter of case, 4¾". Shipping weight 4 lbs., 7 oz.

Standard Range: 50 to 600° F.

LIST PRICES

Figure M-51 furnace control single pole	$18.00
Figure M-51 furnace control two pole or two circuit add to list	6.00

THE MERCOID CORPORATION

Mercoid Furnace Controls

For Warm Air Furnaces

A POSITIVE SAFETY DEVICE TO PREVENT OVERHEATING

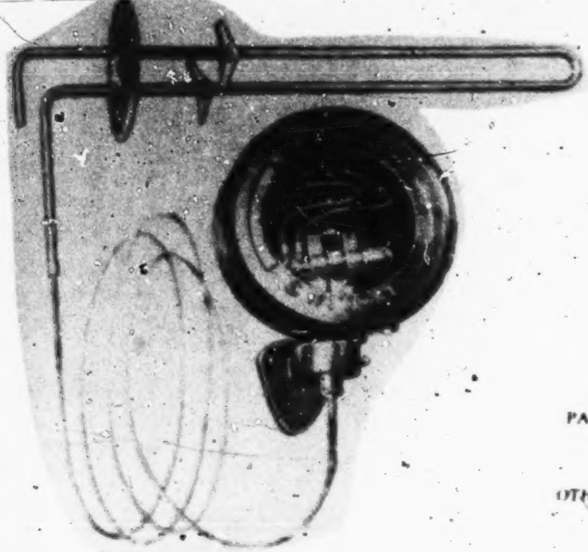


Figure 50

PAT. ISSUED
1521638
1598874
1640000
1658013
OTHERS PEND.

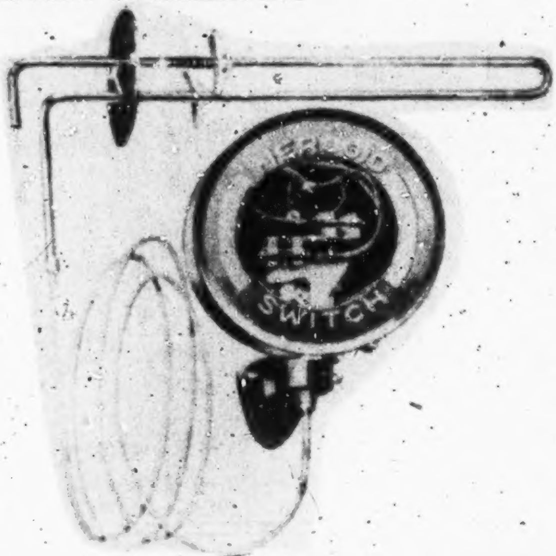


Figure 50-L 3-Wire

FIGURE 50

Will handle currents up to 10 amperes at 110 volts or 5 amperes at 220 volts, A. C. or D. C.

FIGURE 50-A

Equipped with Fig. 17 Mercoid Tube. For applications where the current requirements do not exceed 3 amperes at 110 volts, A.C. or D.C.

FIGURE 50-L (3 Wire)

Designed for 3-Wire or low voltage installations Furnished with one each, red, white and blue binding posts. Will handle currents not in excess of 1 ampere at 110 volts, A..C. or D. C.

THE instruments shown above are designed for operation on warm air furnaces. The bronze remote stem, charged with an expansive liquid, is intended for installation in the furnace hood above the dome, while the instrument proper may be mounted conveniently on a wall, by means of the bracket provided therefor, as shown in the illustration. Where so installed this control operates as a positive safety device to prevent over-heating. Standard range 250° F. to 300° F., opening the electric circuit at the high point and restoring it on a 50° drop in temperature in the furnace dome. The range may be adjusted by simply sliding the stem in or out of the furnace hood, also by the standard adjustment on the back of the case. Regularly furnished fully automatic; may be furnished semi-automatic, with hand reset, where specified.

Orders should specify whether circuit is to close on rise or fall in temperature.

As a furnace fan control, for automatic control of booster fans on warm air furnaces, the standard range is 190° F. to 140° F., cutting in at high point to start the fan motor and cutting out when the dome temperature drops to the low point.

LIST PRICES:

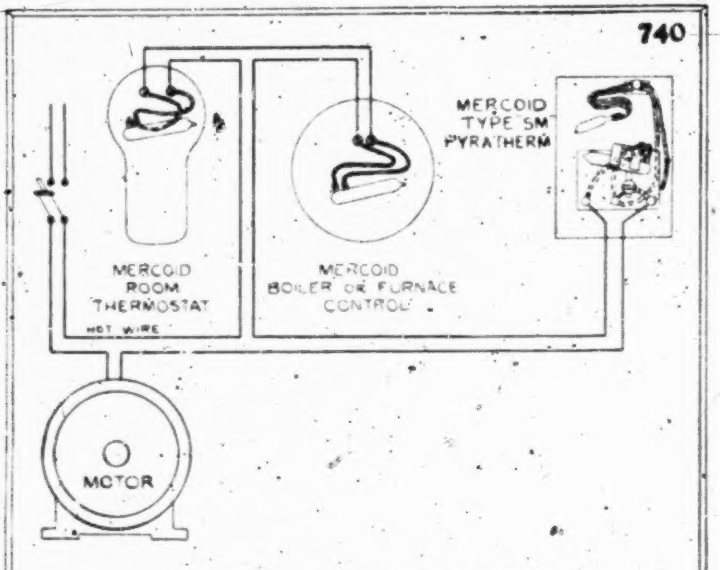
Fig. 50, $27.00 Fig. 50A, $24.00 Fig. 50L, $27.00

For 2 Pole or two circuit add to list 6.00

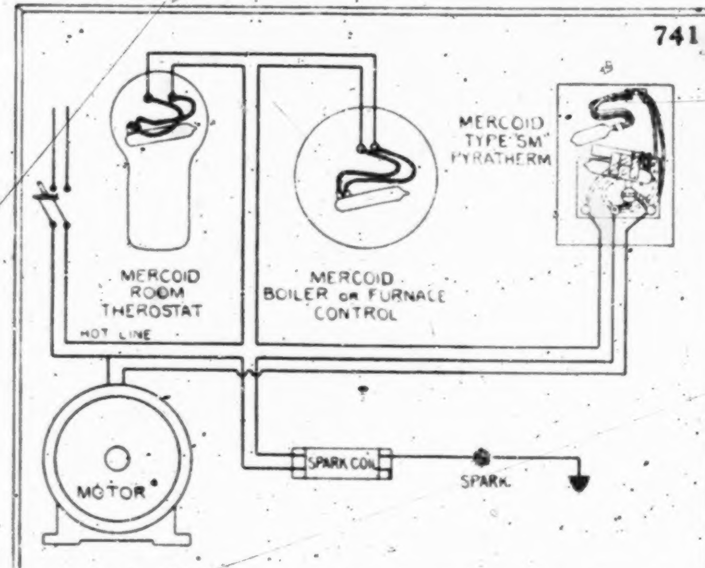
Shipping Weight 6 lbs. 11 oz.

TYPICAL MERCOID WIRING DIAGRAMS

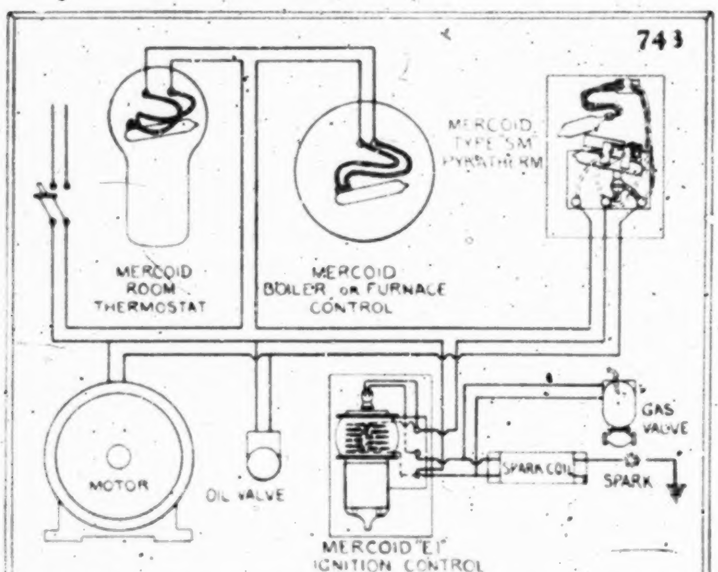
THE simplicity of the Mercoid system of 2-wire direct control is fully recognized. There are no confusing or intricate wiring installations to be made. The hazards and expense of improper hookup are avoided.



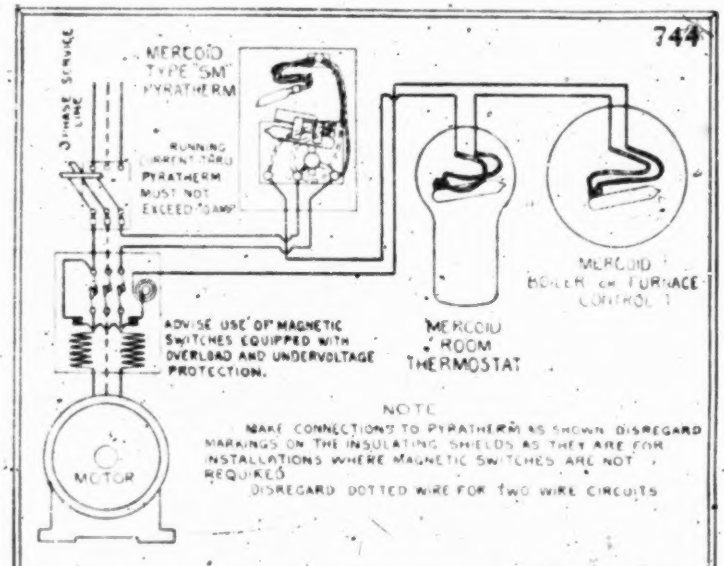
WIRING OF "SM" PYRATHERM



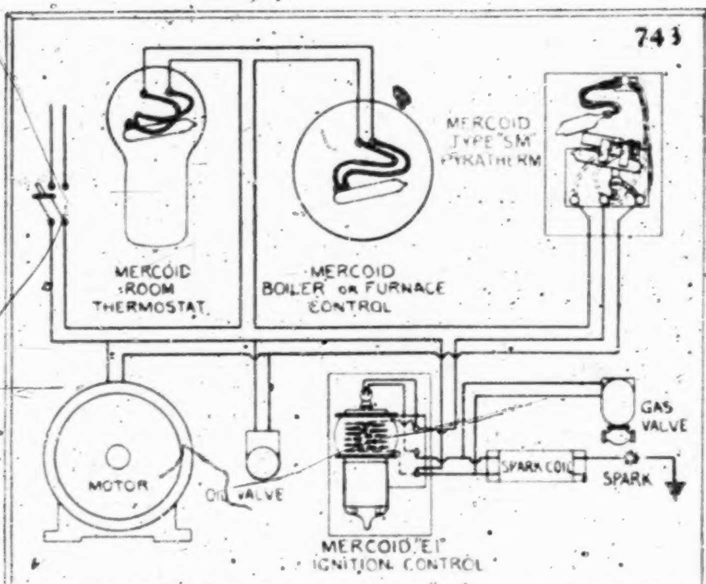
WIRING OF "SM" PYRATHERM WITH CONTINUOUS IGNITION



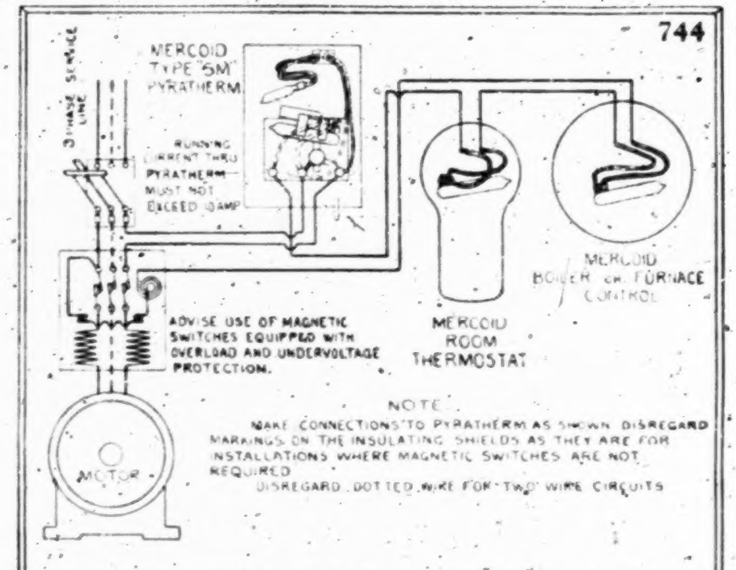
WIRING OF "SM" PYRATHERM AND "EI" IGNITION CONTROL



3 PHASE WIRING DIAGRAM FOR "SM" PYRATHERM

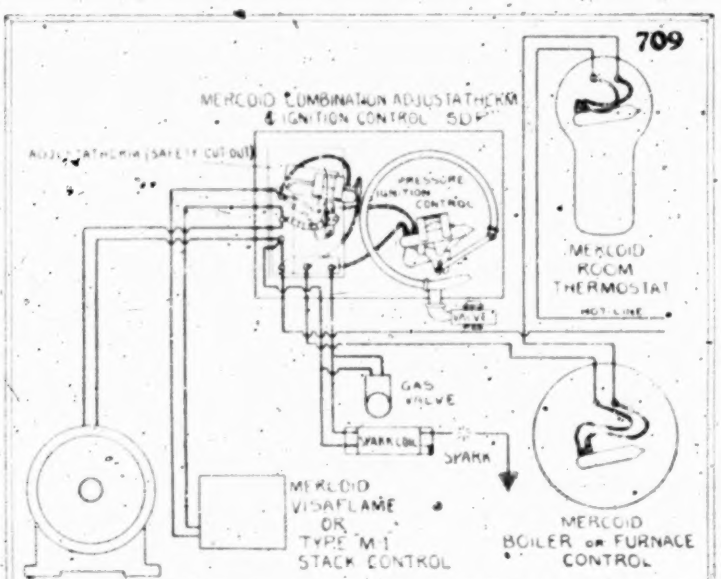


WIRING OF "SM" PYRATHERM AND "EI" IGNITION CONTROL

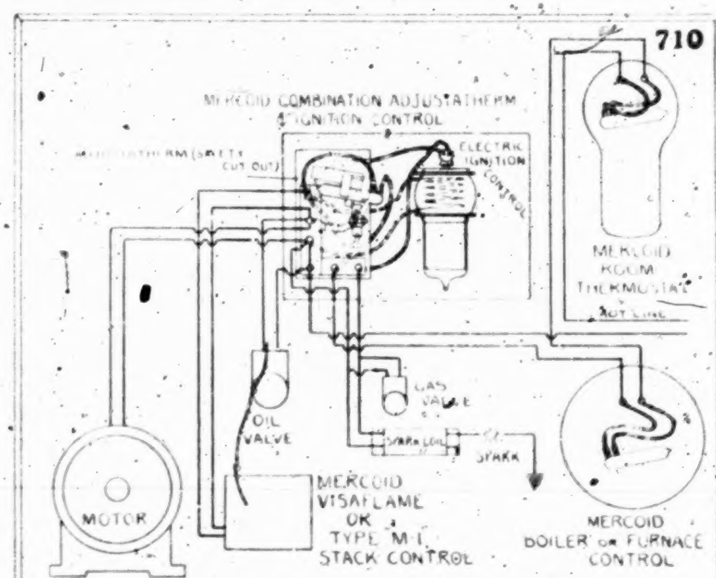


3-PHASE WIRING DIAGRAM FOR "SM" PYRATHERM

The hookups shown above are typical of the usual oil burner installations in connection with the Pyratherm Type SM



WIRING OF "SDP" PANEL UNIT & MERCOID SAFETY CONTROL



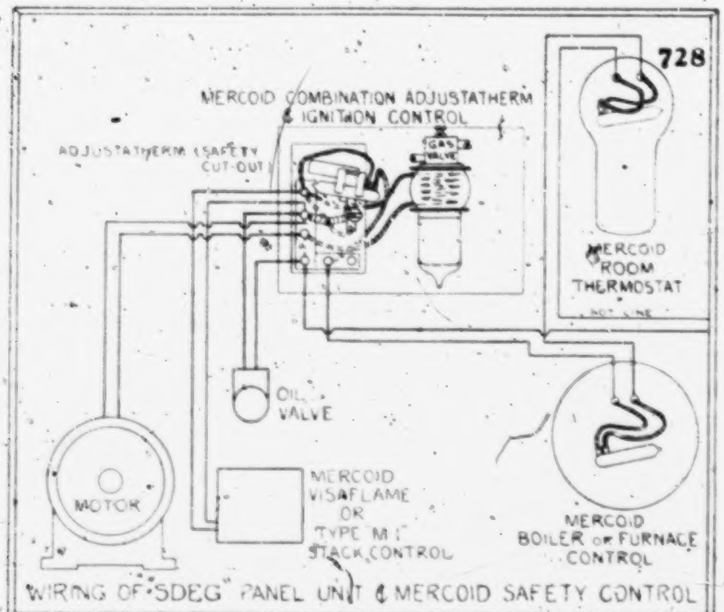
WIRING OF "SDE" PANEL UNIT & MERCOID SAFETY CONTROL

The hookups shown above are typical of the usual oil burner installations in connection with Mercoid Panel units SDP and SDE.

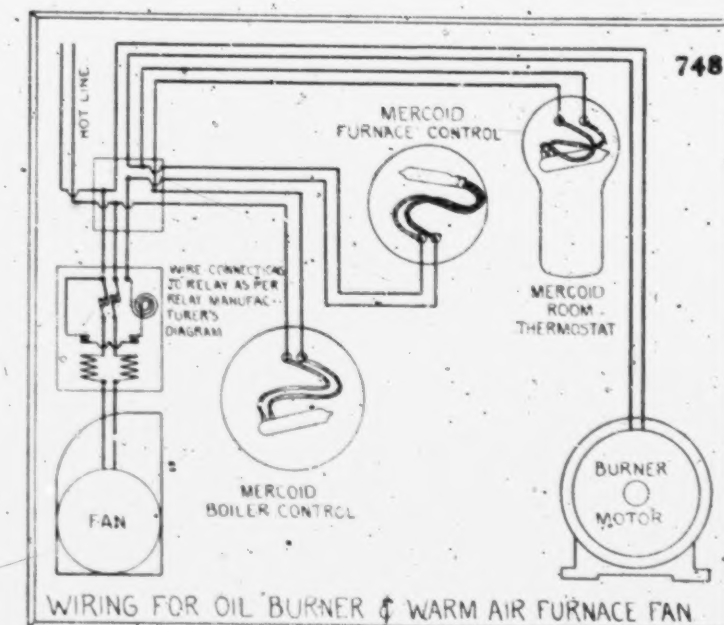
827

TYPICAL MERCOID WIRING DIAGRAMS

THE simplicity of the Mercoid system of 2-wire direct control is fully recognized. There are no confusing or intricate wiring installations to be made. The hazards and expense of improper hookup are avoided.

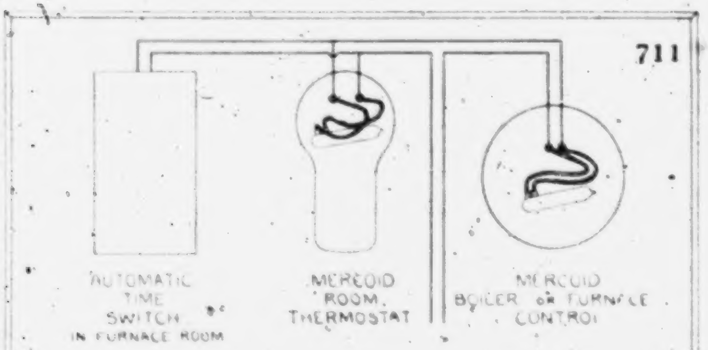


WIRING OF "SDEG" PANEL UNIT & MERCOID SAFETY CONTROL



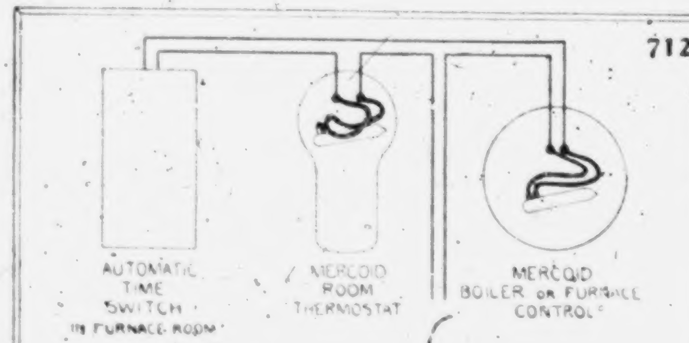
WIRING FOR OIL BURNER & WARM AIR FURNACE FAN

The diagram to the left is a hookup showing the use of Mercoid Panel Unit SDEG. The diagram to the right is connection with the use of Mercoid Figure M-51 and Figure 50.



THERMOSTAT HOOK UP WITH 8 DAY CLOCK
USER SETS THERMOSTAT BACK BEFORE RETIRING AT A PREDETERMINED HOUR IN THE MORNING TIME CLOCK OPERATES BURNER FOR A LIMITED PERIOD WHEN USER ARISES HE RESTORES THERMOSTAT TO NORMAL
HAS ADVANTAGE OF GIVING HEAT IN EVENING AS LONG AS REQUIRED.
SUITABLE FOR RESIDENTIAL USE.

DIAGRAM WITH AUTOMATIC TIME SWITCH



THERMOSTAT HOOK UP FOR 8 DAY CLOCK FOR AUTOMATIC OPERATION
REQUIRES SPECIAL DOUBLE OPERATION CLOCK
CURRENT TO BURNER CUT OFF SAY AT 10 PM. CUT IN AT 2 A.M. FOR ½ TO ONE HOUR AS DESIRED — CUT IN AGAIN AT 6 A.M. FOR REST OF DAY
SUITABLE FOR HOMES, APARTMENTS ETC.

DIAGRAM WITH AUTOMATIC TIME SWITCH

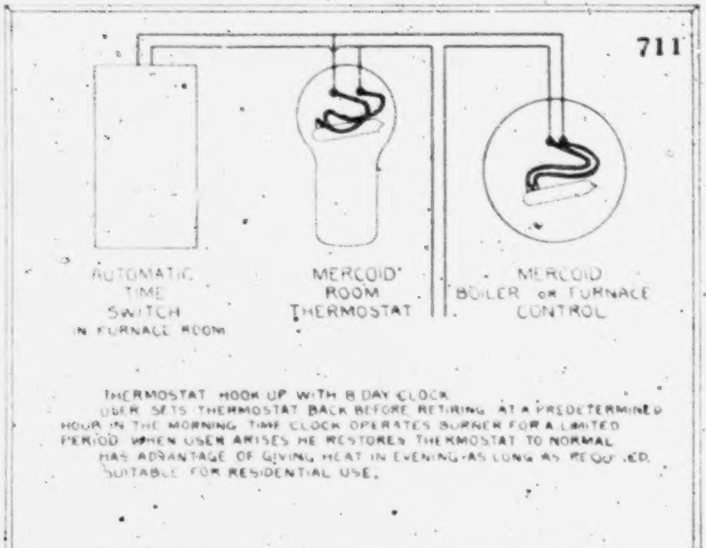


DIAGRAM WITH AUTOMATIC TIME SWITCH

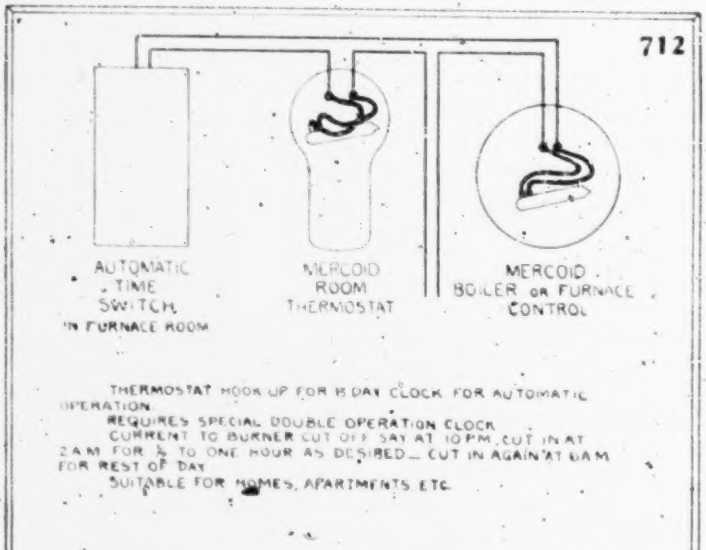
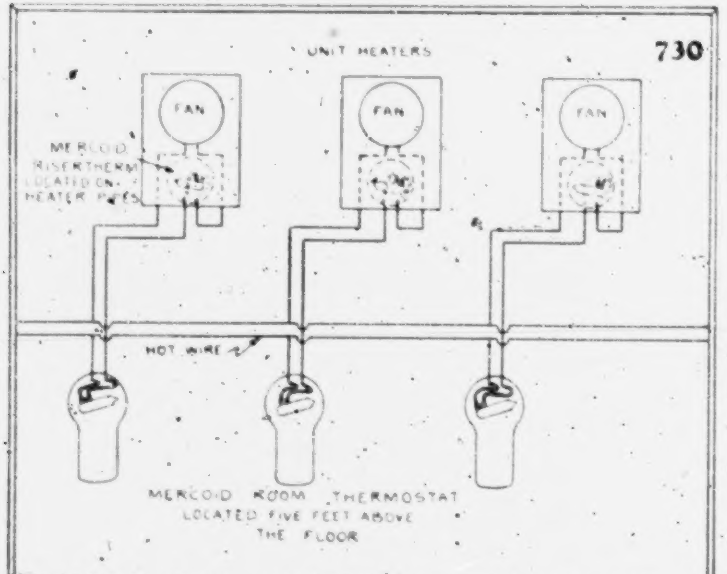
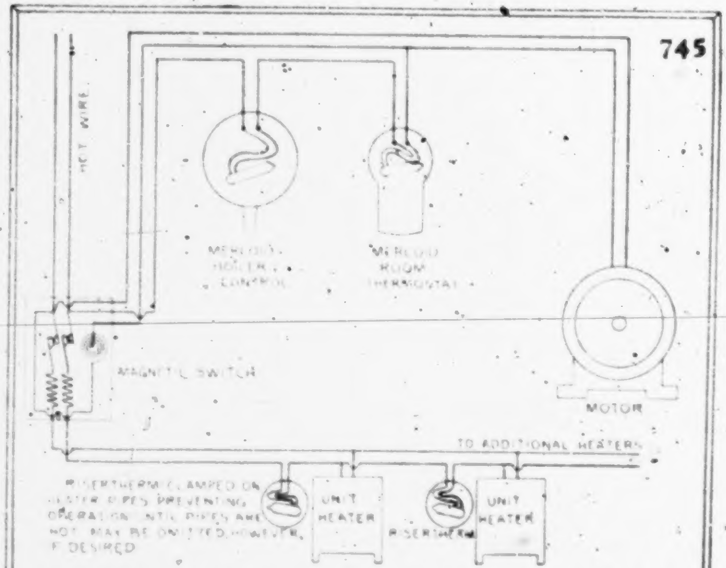


DIAGRAM WITH AUTOMATIC TIME SWITCH

Suggested methods for hookup of time switch and thermostat. Standard time switch may be purchased from local electrical supply house.



MERCOID DUAL CONTROL OF UNIT HEATERS



OIL BURNER INSTALLATION WITH UNIT HEATERS

The above wiring diagrams show the application of Mercoid Risertherm in connection with Unit Heater installations.

5-7-28
CHARLES A. LAWES CO.
CHICAGO


MERCOID
USED THE WORLD OVER
WARM AIR
FURNACE
CONTROL
M-51
M-52
M-53

lletin S-83

Mercoid Furnace Controls

A New Design in Warm Air Furnace Controls Employing a Thermostatic Metal Coil

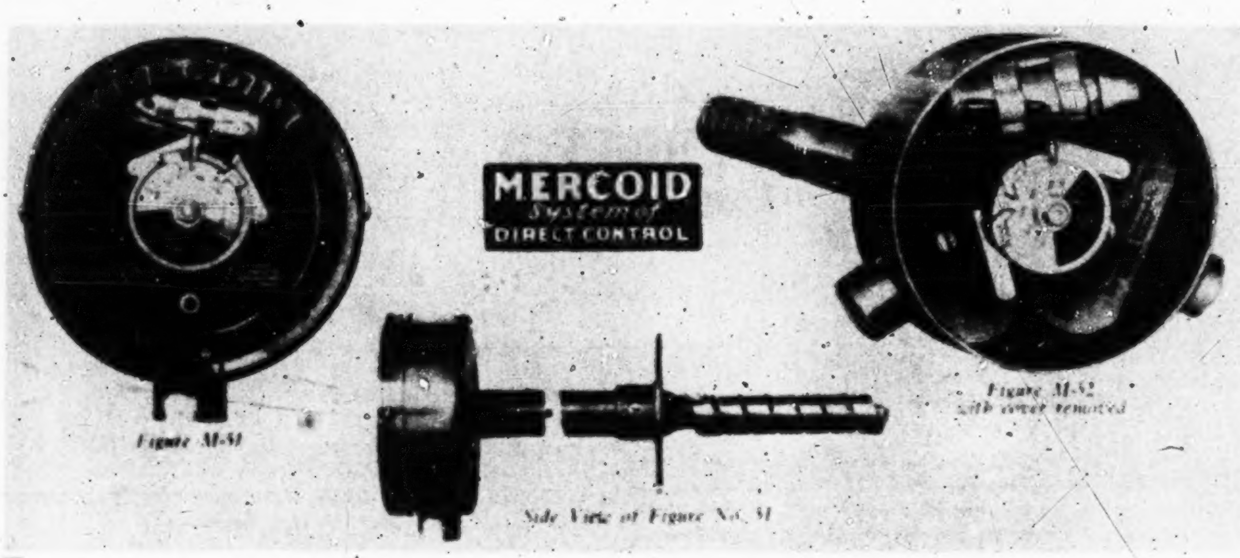


Figure M-51

Side View of Figure No. 51

Figure M-52 with cover removed

FIGURE M-51

The M-51 Mercoid Furnace Control has been designed primarily to prevent the overheating of warm air furnaces in connection with automatic fuel burning systems.

It is of unique construction and provides a positive and complete means of furnace control, at a moderate price.

DOUBLE ADJUSTMENT FEATURE

This instrument has the advantage of a simple double adjustment for both high and low operating temperatures to meet the variety of conditions encountered in warm air furnace installations.

The double adjustment mechanism, located within the case of the instrument and readily visible through the glass front, is easily accessible to the installer yet not subject to accidental disarrangement or casual tampering by unqualified persons. Being a limiting device, designed to guard against excessive temperatures which might cause fire hazards or damage to the furnace itself, it is important that after once correctly set that its adjustment be maintained.

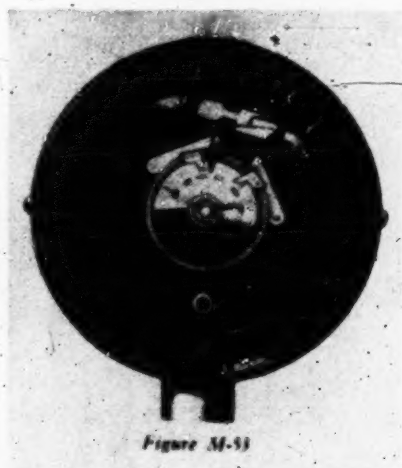


Figure M-53

The fluctuations in furnace temperatures, whether great or small, rapid or slow, are all met by means of this double adjustment feature. What these fluctuations actually are may be determined by means of the temperature indicator in the control.

DUCT TEMPERATURE INDICATOR

The duct temperature indicator, located over the dial, also serves the purpose of a switch tilting arm.

While the accuracy of the temperature indication will vary within certain limits, depending upon the adjustment of the control itself, it is sufficiently accurate for ordinary purposes to enable the service man to check the proper size of fire. In this respect its usefulness is comparable to that of the thermometer on a hot water boiler or the pressure gauge on a steam plant.

BIMETALLIC ELEMENT

The Mercoid Furnace Control is actuated by a single bimetallic element and is designed so that it both controls the switch and indicates the temperature. A novel construction permits the bimetallic element to maintain its natural course after the switch has been thrown to "off" or "on" position.

MERCOID SWITCH

The Mercoid switch used in the M-51 control is of the latest improved type. It has the tipless tube and protected leads. Its construction throughout provides greater efficiency in "make" and "break" contact. It will operate indefinitely without deterioration.

Mercoid Furnace Controls

A Positive Safety Device to Prevent Overheating of Warm Air Furnaces

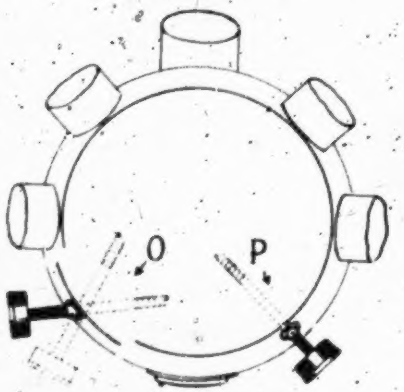


Illustration 5

MERCOID
System of
DIRECT CONTROL

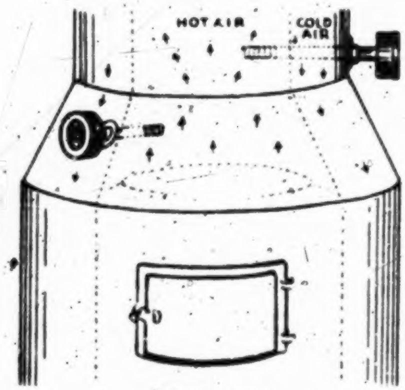


Illustration 6

INSULATION

Since all adjustments are made within the case, ample protection has been provided against accidental contact with live parts of terminals.

TEMPERATURE DIAL

The dial, located in the center of the instrument, is calibrated from 50 to 650 degrees Fahrenheit, in conformance with the physical characteristics of the bimetallic element.

The average furnace temperature, range adjustments are likely to be set somewhere between the 200 and 400 degree marks.

FLANGES

There are two types of flanges, which will enable the installer to place the instrument in almost any required position on the furnace.

The furnace type regularly supplied has a distinctive adjustment feature, which enables the installer to place the instrument on the hood of a furnace where the angle is 45 degrees or less. At a 45 degree angle the instrument will project at a proper level with a radius directly from the center, as shown in "P", illustration 5, or "K", illustration 7. If the angle is less than 45 degrees the correct operating position may still be maintained, by turning the flange until the instrument is horizontal.

In this case the instrument will not have a direct radius from the center but will tend either to one side or the other, as shown in "O", illustration 5. Where the instrument is placed somewhat on the side of a vertical section of the furnace and it is desired to have the face of the control toward the front, this is accomplished by turning the opening of the flange toward the front, as indicated in "L", illustration 7.

The stack type, furnished only when specified, is suitable for duct installation as shown in "M", illustration 7 or on an upright section of a furnace as shown on right side of pipeless furnace, illustration 6.

Both flanges are made of steel and may be reshaped to fit different contours without any danger of breaking.

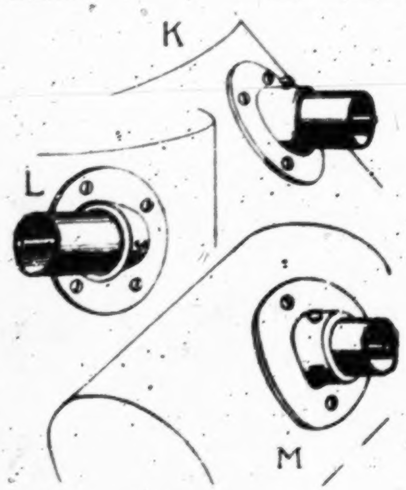


Illustration 7

FIGURE M-52

This control is supplied as a two circuit device for use with three wire systems wherein one circuit is required to be made and the other broken simultaneously.

FIGURE M-53

This control is arranged to make the circuit when the temperature rises and is identical with the M-51 with the exception that the Mercoid switch is reversed. Usually used in connection with booster furnace fan applications.

Shipping weight 4 lbs. 7 oz. Size of instrument 16½" long overall. Diameter of case 4¾".

PRICE LIST

Single Circuit			*Single Pole*	*Double Pole*
M-51 & M-53	10 amperes 110 volts	5 amperes 220 volts A. C. or D. C.	$18.00	$24.00
M-51A & M-53A	3 amperes 110 volts	1½ amperes 220 volts A. C. or D. C.	16.00	18.00

Two Circuit

M-52	10 amperes 110 volts	5 amperes 220 volts A. C. or D. C.	$24.00
M-52A	3 amperes 110 volts	1½ amperes 220 volts A. C. or D. C.	18.00

Installation Instructions

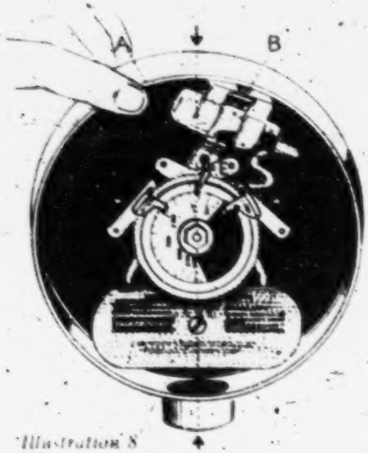


Illustration 8

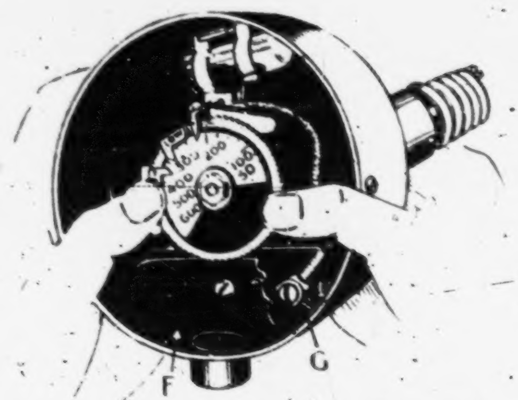


Illustration 9

All instruments should be handled carefully. After removing all packing material note tag warning not to twist the bimetallic element. To do so might distort the metal and disarrange the adjustment which was correctly made at the factory.

Care should be given in selection of proper location for both appearance and operation. Do not locate bimetallic element closer than three inches from the dome.

After proper location has been determined, cut a $1\frac{1}{4}$" hole in the furnace with a rotary hack saw. Place flange over hole and see that it is perfectly level. This may be done by twisting flange until the proper level has been obtained. Then mark and drill the holes for fastening and attach bolts. Before bolting be sure that the stem when inserted will be perfectly horizontal in position.

If the angular surface of the furnace is less than 45 degrees the instrument will face a little to the right or left and may be placed to the side most desirable, see "O", illustration 5. After the flange has been fastened and the stem properly inserted it is important that the case of the instrument be plumb or vertical in position. This may be determined by separating the high and low adjustable pointers, "C" and "D", illustration 8, far enough apart so they will hold the switch kicking plates away from the switch tripping arm "E". The switch must move freely from left to right without interference of the kicking plates. If the switch remains to the right or left, after tilting with the finger, the instrument is ready to be fastened by tightening set screw on flange.

Connect wires next. Remove insulating plate indicated as "F" in illustration 9 by removing screw located in center of plate. After wires are connected to terminal posts, one of which is shown in drawing as "G", fasten plate back in position.

Then adjust instrument to the desired operating point. While the majority of warm air installations are set at approximately 250 to 300 degrees there are many installations in which this particular adjustment might be insufficient or excessive, therefore a careful study of each case must be made. Bear in mind that the same results of operation can be obtained by locating the bimetallic element farther away from the dome and adjusting it to operate at a lower range. When setting the cut-in and cut-out points, hold the ratchet wheel firmly with one hand while pressing and moving either the high or low pointer; see illustration 9. When pressing pointers see that the catch between the teeth of the ratchet wheel is disengaged, as shown in "I", illustration 10. When releasing the pressure be certain that the catch is again engaged, as shown in "J".

At no time should the instrument be subjected to more than 650 degrees Fahrenheit.

The instrument leaves the factory with the bimetallic element properly heat-treated, formed, stabilized and calibrated. Should the temperature reading be in error due to someone's twisting the bimetallic element, if not excessively twisted, it may be readjusted by allowing the instrument to reach room temperature, loosening the nut in the center of dial and moving dial until correct reading is obtained, after which the nut should be tightened.

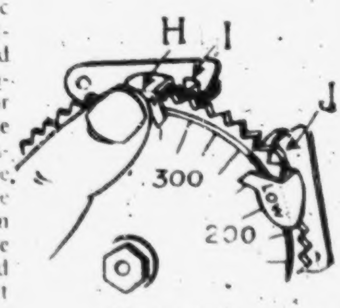
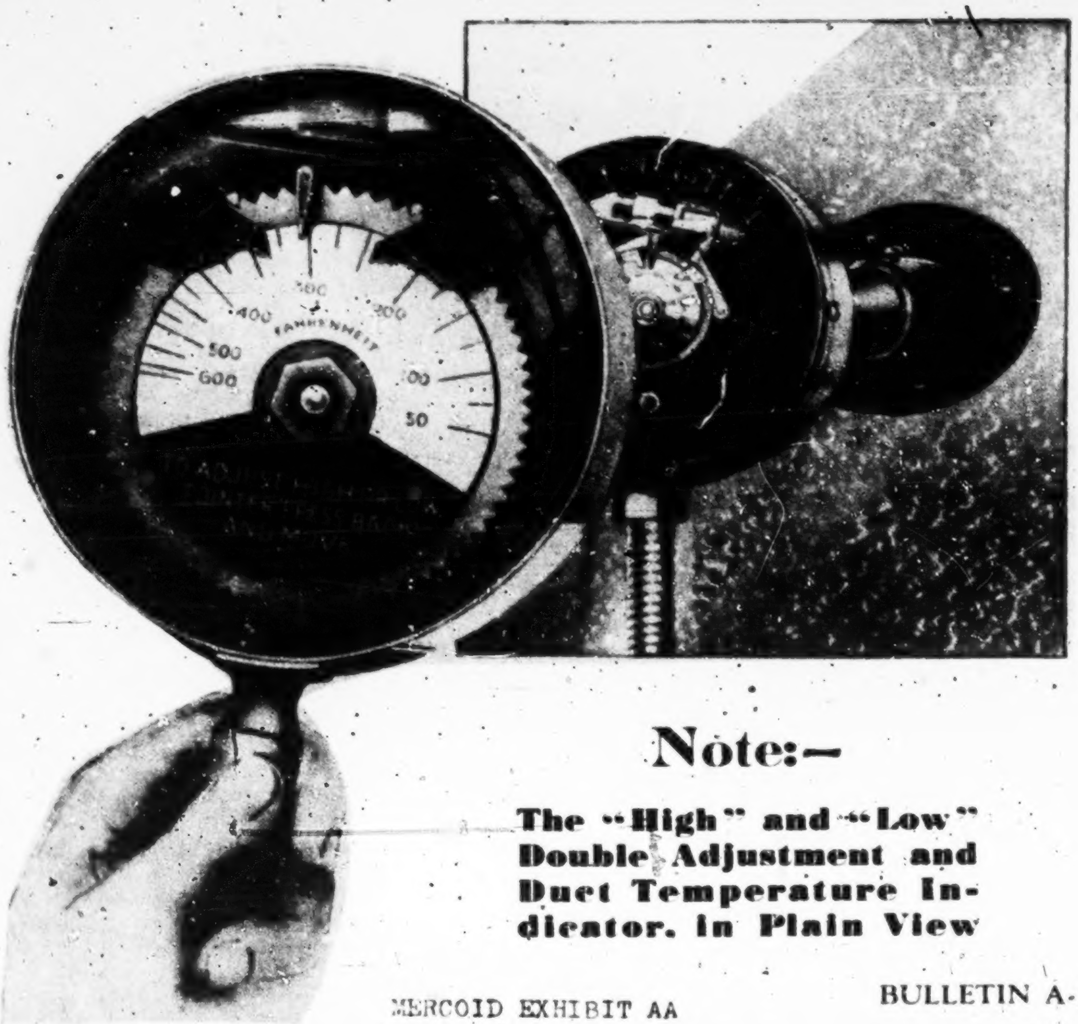


Illustration 10

Any manual twisting or bending of the element may permanently distort it. Not only will this destroy the correct calibration of the instrument but also the accurate performance after adjustment is made. It is recommended in case of a badly distorted bimetallic element, that the instrument be either sent back to the factory for re-calibration or a new bimetallic element ordered for replacement. In ordering element for replacement the serial number of the instrument should be supplied.

MERCOID M-53
WARM AIR FURNACE FAN CONTROL



Note:—

The "High" and "Low" Double Adjustment and Duct Temperature Indicator. in Plain View

MERCOID EXHIBIT AA

BULLETIN A-5

THE MERCOID CORPORATION
4201 BELMONT AVENUE
Chicago, Illinois, U.S.A.

25 CHURCH STREET
New York, N. Y.

3129 FOLSOM STREET
San Francisco, Calif

Cable Address "Mercoid" Chicago

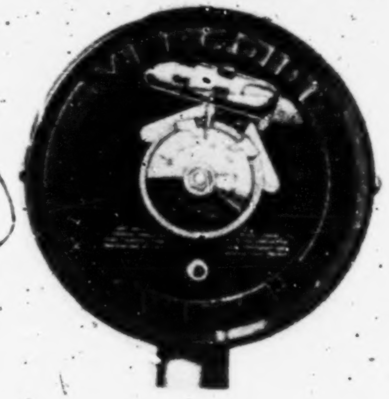
Mercoid distributors are located in the larger cities of the United States, Canada, Great Britain, Denmark, Australia, New Zealand and other parts of the world

Mercoid M-53 Warm Air Furnace Fan Control

The Ideal Control for All Types of Booster Fan Applications. Sturdy in Construction. Reliable Performance. Indicates the Temperature in the Furnace Jacket. Meets practically all Operating Conditions. Its use is fully protected under Reissue Patent Number 15,531.

(Additional Patent Nos 1598874, 1640869, 1705980. Others pending.)

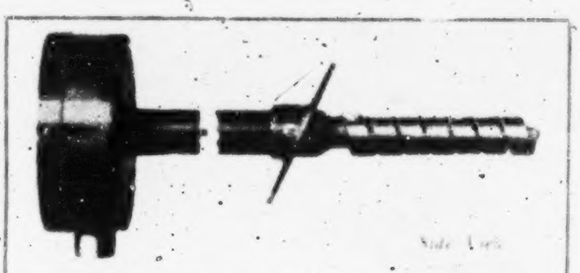
THE efficiency of a warm air furnace is greatly increased through the use of a Mercoid controlled furnace fan, which operates economically, is convenient to adjust and saves fuel and time. It may be applied on any warm air furnace where coal, oil or gas is used for fuel.



The Mercoid M-53 Warm Air Furnace Fan Control is neat in appearance and constructed to render dependable service.

It is equipped with the Mercoid Tipless Tube, the latest development in enclosed mercury contact switches.

The average furnace temperature range adjustment, on controls for booster fan application, is usually somewhere between 120 degrees and 150 degrees, but this may be varied to suit individual conditions. When the furnace delivers heat at a temperature of 150 degrees or higher, the fan starts and it continues to operate until the temperature drops to 120 degrees or less, when the fan will stop.



Side View

Where the hook-up includes a Mercoid room Thermostat the fan starts at the cut-in point of Control M-53, after the temperature in the furnace hood reaches 150 degrees. The thermostat in the room, if set at 68 to 70 degrees, will stop the fan when the room temperature rises to 70 degrees, and again start the fan when the temperature goes below 68 degrees, providing the temperature has not dropped below the cut-out point of the M-53 control, thus maintaining a uniform temperature. The M-53 control in this hook-up prevents the fan from blowing cold air in the rooms if the furnace is not hot enough to deliver heat.

The mechanism (in the M-53 Furnace Fan Control) has many outstanding features. It is unique in design and has the advantage of a simple double adjustment, for both "high" and "low" operating temperatures, to meet the variety of conditions encountered in warm air furnace installations.

The fluctuations in furnace temperatures, whether great or small, rapid or slow, are all met by means of this double adjustment feature. These fluctuations may be determined by means of the duct temperature indicator located over the dial, which also serves the purpose of a switch-tilting arm.

While the accuracy of the temperature indication will vary within certain limits, depending upon the adjustment of the control itself, it is sufficiently accurate (for

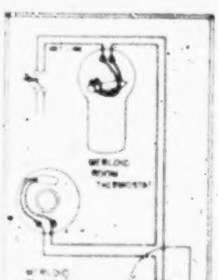


Illustration 4
Simple diagram generally used for coal burning applications

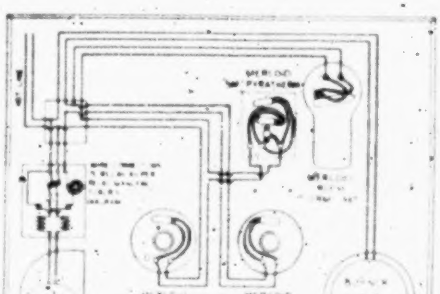


Illustration 5
Diagram used where the current capacity of the two motors exceeds 10 amperes, making it necessary to use a relay or magnetic starting switch

Illustration 6
Diagram used where current capacity of each motor does not exceed 10 amperes, 110 volts. A single pole thermostat can be used when the combined motor load does not exceed 10 amperes, 110 volts

ordinary purposes) to enable the service man to check the proper size of fire. In this respect its usefulness is comparable to that of the thermometer on a hot water boiler or the pressure gauge on a steam plant.

The dial, located in the center of the instrument, is calibrated from 50 to 650 degrees Fahrenheit, in conformance with the physical characteristics of the bimetallic element which actuates the control. This element is designed so that it both operates the switch and indicates the temperature. Its novel construction permits the bimetallic element to resume its natural course after the switch has been thrown to "off" or "on" position.

Where used on furnaces heated by oil burners, the M-53 fan control usually employs additional controls on such equipment, as shown in the wiring diagrams, illustrations 5 and 6, and listed elsewhere.

Two types of flanges are available, permitting the instrument to be placed in almost any required position.

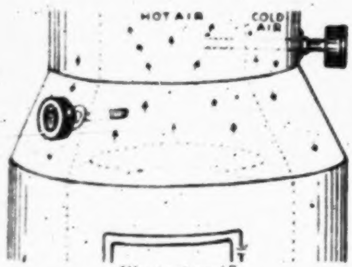


Illustration 7

The furnace type, regularly supplied, has a distinctive adjustment feature which enables the installer to place the instrument on the hood of a furnace where the angle is 45 degrees or less. At a 45 degree angle the instrument will project at a proper level with a radius directly from the center, as shown in "K", illustration 8, and on the left side of illustration 7. If the angle is less than 45 degrees the correct operating position may still be maintained by turning the flange until the stem of the instrument is horizontal and the face of the instrument parallel with the front of the furnace.

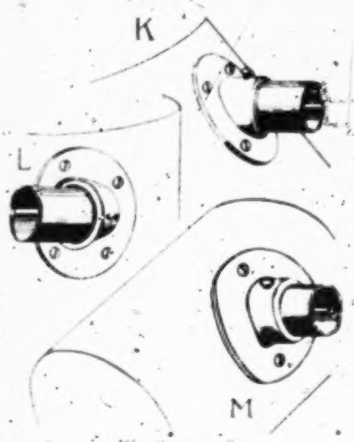


Illustration 8

The stack type flange, furnished only when specified, is suitable for duct installation as shown in "M", illustration 8, or on an upright section of a furnace as shown on the right side of a pipeless furnace, illustration 7.

Both types are made of steel and may be reshaped to fit different contours without any danger of breaking.

MERCOID CONTROLS

The following controls may be used in conjunction with the M-53 control on certain types of installations.

Mercoid Thermostat Figure 21

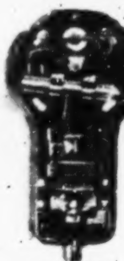


Fig. 21

The Mercoid Thermostat is designed to control an electric circuit through changes in room temperature. For warm air systems, equipped with booster fans, positive and reliable performance is assured by the use of the Mercoid Thermostat.

This instrument has been proven in service over a long period and has established a record for accurate unfailing performance.

STANDARD RANGE:

56 degrees to 80 degrees Fahrenheit with 2 degrees operating differential.

LIST PRICES	Fig. 21
Single Pole	$30.00
Two Pole	36.00
Two Circuit	36.00
For Special Range, add	4.00

Where thermometer is specified on any of above types, add $2.00.

Mercoid Furnace Control Figure M-51


Fig. M-51

The M-51 Mercoid Furnace Control has been designed primarily to prevent the overheating of warm air furnaces in connection with automatic fuel burning systems. The construction of this control is similar to the M-53, with the exception that the position of the switch is reversed.

Single Circuit	PRICE LIST			Single Pole	Dbl. Pole
M-51	10 amps. 110 v.	5 amps. 220 v.	A.C or D.C.	$18.00	$24.00
M-51A	3 amps. 110 v.	1½ amps. 220 v.	A.C. or D.C.	16.00	18.00

Mercoid Furnace Control Figure M-52


Fig. M-52

This control is supplied as a two circuit device for use with three wire systems where one circuit is required to be made and the other broken simultaneously.

TWO CIRCUIT				
M-52	10 amps. 110 v.	5 amps. 220 v.	A.C. or D.C.	$24.00
M-52A	3 amps. 110 v.	1½ amps. 220 v.	A.C. or D.C.	18.00

Mercoid Pyratherm Type SM


Type S.M.

The Mercoid Pyratherm Type SM is a complete stack safety control, combining two instruments in one: Type M Pyratherm Stack Safety Control and Type S Adjustatherm Safety Cutout. Designed for flue installation, providing protection against flame or ignition failure.

Used on burners having either constant ignition or constant gas pilot, or where the ignition is a separate feature.

LIST PRICE	
Type SM Pyratherm with Adjustatherm	$30.00

PRICE LIST M-53 FAN CONTROL

Single Circuit				Single Pole	Double Pole
M-53	10 amperes 110 volts	5 amperes 220 volts	A. C. or D. C.	$18.00	$24.00
M-53A	3 amperes 110 volts	1½ amperes 220 volts	A. C. or D. C.	16.00	18.00

Shipping weight 4 lbs. 7 oz. Size 16½" long overall. Diameter of case 4¾".

Installation Instructions

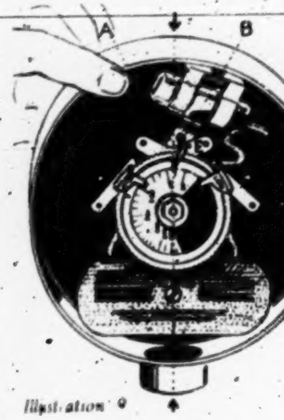


Illustration 9

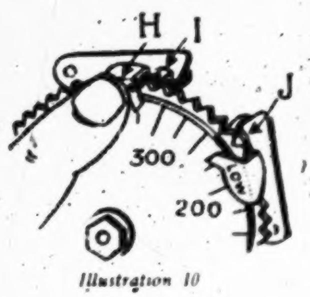


Illustration 10

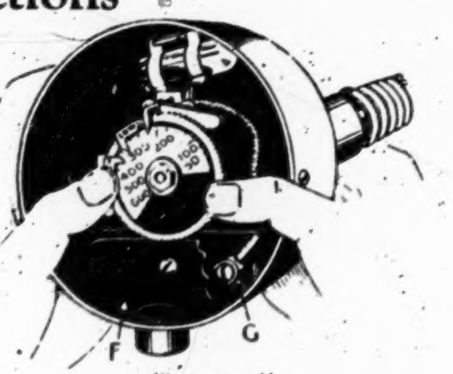


Illustration 11

All instruments should be handled carefully. After removing all packing material note tag warning not to twist the bimetallic element. To do so might distort the metal and disarrange the adjustment which was correctly made at the factory.

Care should be given in selecting a proper location for

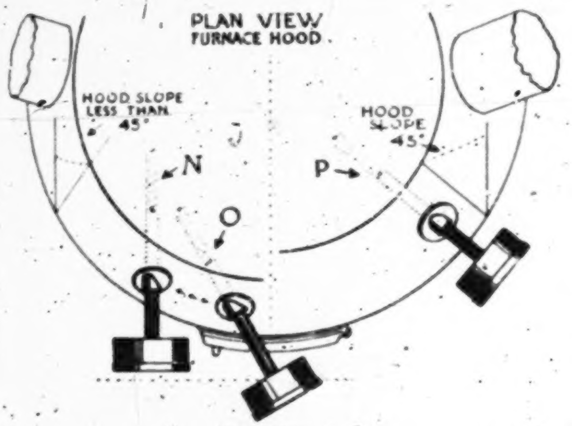


Illustration 12

both appearance and operation. Do not locate bimetallic element closer than three inches from the dome.

The instrument is usually placed on the sloped hood of the furnace. If the slope has an angle of 45 degrees the instrument will always be at a radius from the center of the dome.

If the slope is less than 45 degrees from the vertical, more care must be exercised in locating the instrument.

Before attempting to cut a hole, bear in mind two things. First, it is necessary that the stem, when inserted in the flange, be horizontal in position. Next, see that the face of the instrument is parallel with the front of the furnace. Turn and move the flange until you have accomplished both of these things, then mark the location for the hole which may be cut by a rotary hack saw. The size of the hole should be 1¼". Insert the stem in the flange, and if the instrument is in correct position, as above mentioned, mark the holes for the screws. (See envelope for instructions.)

Illustration 12, "P", shows the control mounted on a 45 degree angle. "O", shows an incorrect mounting, where the angle is less than 45 degrees. It should have been moved to the left as shown in "N".

Before fastening set screws, see that the instrument is plumb or vertical in position. This may be determined by separating the "high" and "low" adjustable pointers, "C" and "D", illustration 9, far enough apart so they will hold the switch kicking plates away from the switch tripping arm "E". The switch must move freely from left to right without interference of the kicking plates. If the switch remains to the right or left after tilting with the finger, the instrument is ready to be fastened by tightening set screw on flange.

Connect wires next. Remove insulating plate indicated as "F" in illustration 11, by removing screw located in center of plate. After wires are connected to terminal posts, one of which is shown in drawing as "G", fasten plate back in position.

Then adjust instrument to the desired operating point.

For fan control the usual setting is about 120 degrees low to 150 degrees high. In case the M-51 is used as a limiting device, the majority of warm air installations are set at approximately 250 to 300 degrees. There are, however, many installations in which this particular adjustment might be insufficient or excessive, therefore a careful study of each case must be made. **Bear in mind that the same results of operation can be obtained by locating the bimetallic element farther away from the dome and adjusting to operate at a lower range.** When setting the cut-in and cut-out points, hold the ratchet wheel firmly with one hand while pressing and moving either the high or low pointer; see illustration 11. When pressing pointers see that the catch between the teeth of the ratchet wheel is disengaged, as shown in "I", illustration 10. When releasing the pressure, be certain that the catch is again engaged, as shown in "J".

At no time should the instrument be subject to more than 650 degrees Fahrenheit.

The instrument leaves the factory with the bimetallic element properly formed, heat-treated, stabilized and calibrated. Should the temperature reading be in error due to someone's twisting the bimetallic element, if not excessively twisted it may be readjusted by allowing the instrument to reach room temperature, loosening the nut in the center of the dial and moving dial until correct reading is obtained, after which the nut should be tightened.

Any manual twisting or bending of the element may permanently distort it. Not only will this destroy the correct calibration of the instrument but also the accurate performance after adjustment is made. It is recommended in case of a badly distorted bimetallic element, that the instrument be either sent back to the factory for re-calibration or a new bimetallic element ordered for replacement. In ordering element for replacement the serial number of the instrument should be supplied.

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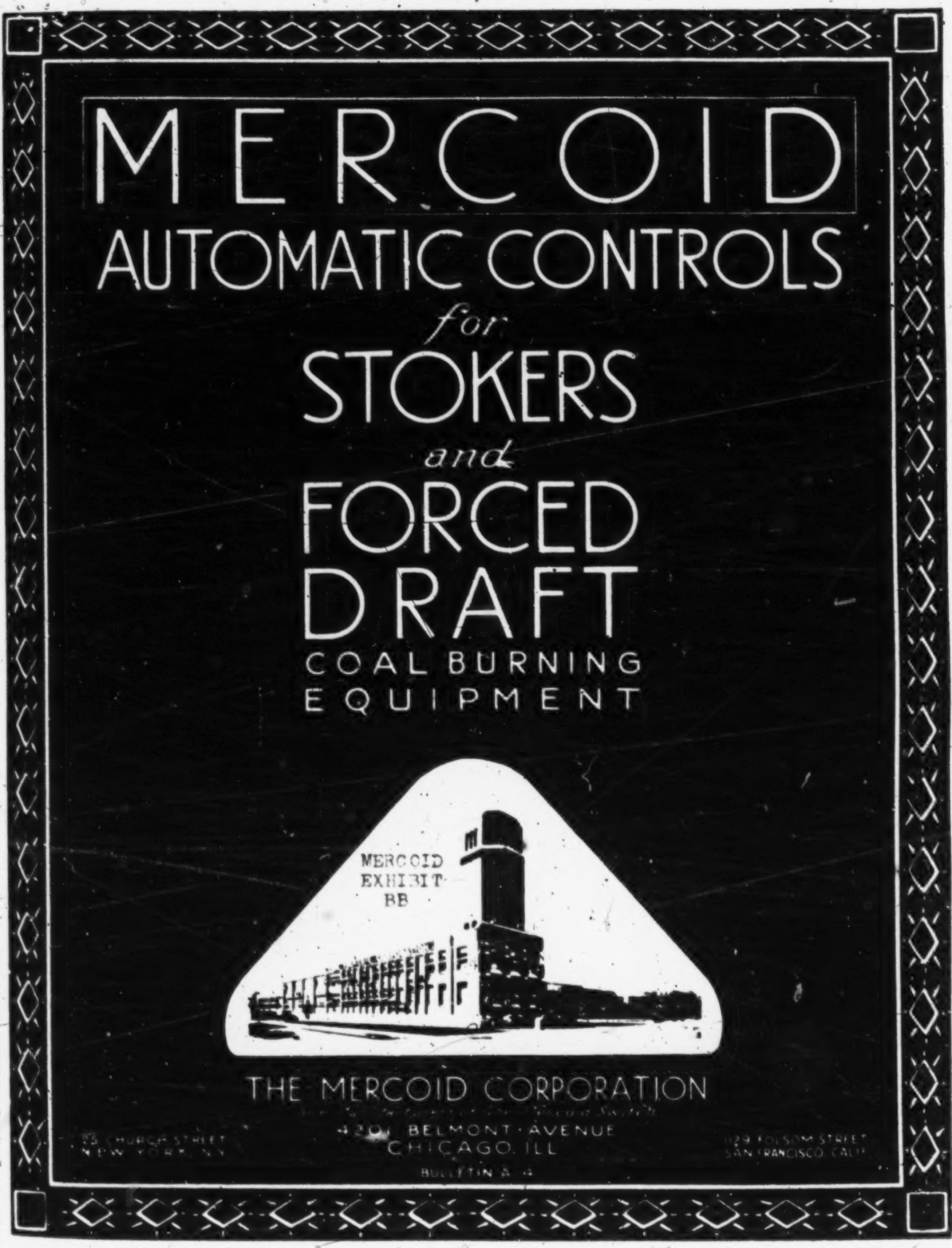

MERCOID
AUTOMATIC CONTROLS
for
STOKERS
and
FORCED
DRAFT
COAL BURNING
EQUIPMENT
MERCOID
EXHIBIT
BB
THE MERCOID CORPORATION
4201 BELMONT AVENUE
CHICAGO, ILL
BULLETIN A-4

MERCOID CONTROLS

THE design and construction of Mercoid controls insure ease of installation and satisfactory performance, with freedom from service expense and replacements.

The advantages of the Mercoid 2-wire system of direct control are recognized, as manifested by an ever-increasing demand.

They are made for automatic or semi-automatic direct control of motors where the normal working load does not exceed 10 amperes at 110 volts or 5 amperes at 220 volts, A.C. or D.C. As pilot switches, where used in series with the proper starting switch, Mercoids will automatically control motors of the largest size. No transformers are required for voltages up to 220.

All types of Mercoid controls employ a sealed glass tube switch, containing inert gases and mercury. There are no exposed conducting surfaces, therefore, the possibility of open arcing, oxidation or corrosion is eliminated.

Our Guarantee

We guarantee Mercoid instruments to be free from defects in workmanship or material and will without charge replace or repair within one year from date of shipment from our factory, any instruments that may be found defective upon inspection at our factory. This guarantee does not obligate us where instruments have been injured by careless handling or by improper application or installation.

THE MERCOID CORPORATION

Mercoid switches are actuated by a snap action movement, which locks the switch at both the "on" and "off" points, preventing premature or erratic operation as the result of a jar or mechanical vibration. MERCOID CONTROLS are listed as standard by the Underwriters' Laboratories, Incorporated.

Every Mercoid Control is carefully tested and inspected before leaving the factory, and if properly installed will give years of satisfactory service without further attention. They should be handled with the care which any instrument of close accuracy requires.

Before installing Mercoid Control check the nameplate to be sure that the operating range is suitable for the condition to be met, and then carefully install after fully reading the installation instructions packed with each control.

ORDERING DATA

IMPORTANT

Mercoid Controls have many varied applications where equipment other than standard is required. Special controls can be furnished without great delay and at moderate prices. When writing for additional data give full information as to the requirements to be met.

It is important that the following information should appear on all orders to insure shipment of the correct material, and to prevent delay occasioned by writing for additional information.

1. Figure or model number.
2. Kind of control.
3. Temperature or pressure range. Specify range and exact cut-in and cut-out points required.
4. Capacity of switch (10 ampere, 3 ampere, etc.).
5. Whether single circuit, two circuit or double pole.
6. If single circuit or double pole, whether to make or break on rising temperature or pressure.

REPAIRS AND CREDITS

Repairs in the field are in most cases impractical. We are equipped to give satisfactory service at reasonable cost.

Returns for credit or for exchange must not be made without our consent. Credit allowed will be subject to 10% deduction for handling and inspection, plus a further charge for recalibrating or refinishing, if necessary. Specially made instruments cannot be credited except at what we determine is fair value to us.

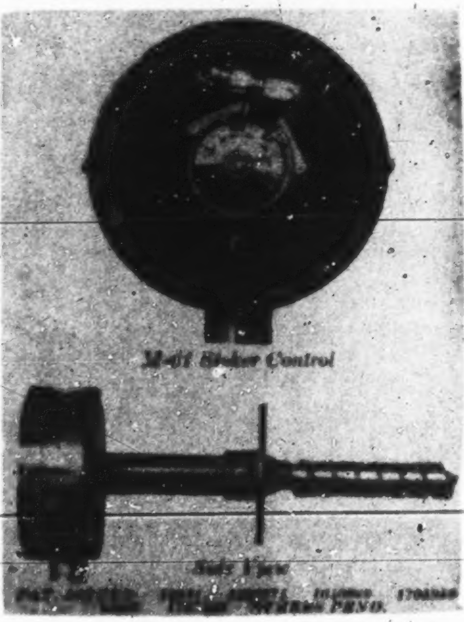
All instruments returned must be carefully handled and properly packed for shipment.

TYPE M-61 STOKER CONTROL

The Type M-61 Mercoid Stoker Control has many outstanding features. It is sturdily constructed and has the advantage of a simple double adjustment, for both "high" and "low" operating temperatures, to meet the variety of conditions encountered in stoker installations. Range adjustable from 50 to 650° F.

The temperature indicator located over the dial serves the same purpose as a thermometer, and will assist at the time installation is made in determining the proper size of fire required and in correctly setting the controls.

The efficiency and general operation of a stoker will be improved by the use of the Type M-61 Mercoid Stoker Control.



When this control is mounted in the stack, set for a low operating temperature, approximately 115 to 130° F., and connected in parallel with the thermostat circuit, it will operate the stoker intermittently for short periods at a time, when the thermostat is in the "off" position. This will not only prevent the fire from going out, but will also maintain a low and even fire bed. (See wiring diagrams.)

When the Fig. M-61 Mercoid Stoker Control is connected in series with the thermostat circuit, and set for a high operating temperature (from 300 to 450° F., depending upon boiler capacity and load on system) the efficiency of the stoker will be increased and fuel will be saved.

When the stoker is firing continuously due to the thermostat calling for heat, the combustion gases will continue to increase in temperature. After a certain temperature is reached, the boiler will be operating at its maximum capacity and further firing would only increase the stack temperature with a resultant waste of fuel. The Mercoid control will stop the stoker from the increase in stack temperature, and the boiler will continue to absorb the heat from the glowing fire bed. When the stack temperature lowers sufficiently the Mercoid control will again start the stoker. This operation will be repeated until the thermostat cuts off.

The Type M-63 Mercoid Stoker Control is identical to the Type M-61 except that it breaks the circuit on a dropping temperature. This control can be employed as an additional safety where required and so set that it will open the circuit and stop the stoker operation in the event the temperature should drop below 100° F. This lower temperature would be reached only in the event the fire had gone completely out, and this control would prevent the stoker from running continually and filling the boiler with fresh coal. A snap switch connected around this control would permit operation of the stoker while the fire was being started.

Type M-51 and M-52 Warm Air Furnace Controls

The Type M-51 Mercoid Control has been designed to prevent the overheating of stoker fired warm air furnaces.

It is identically the same as the Fig. M-61 stoker control, except that it has an adjustable mounting flange and a longer sleeve which permits the bi-metal operating coil to extend farther into the furnace. By means of the adjustable flange the instrument can be easily installed on any furnace hood where the angle is from 30 to 90 degrees.

The Type M-52 Mercoid Control is identically the same as the Type M-51, except that it has two separate circuits, the one closing on a dropping temperature and the other on a rising temperature.

On a stoker fired warm air furnace equipped with an air circulating fan, this control serves a dual purpose. It will intermittently fire the stoker for short periods at a time when the thermostat is in the "off" position, and will permit operation of the circulating fan only when the thermostat is calling for heat and the furnace is heated. (See wiring diagram No. 3.)

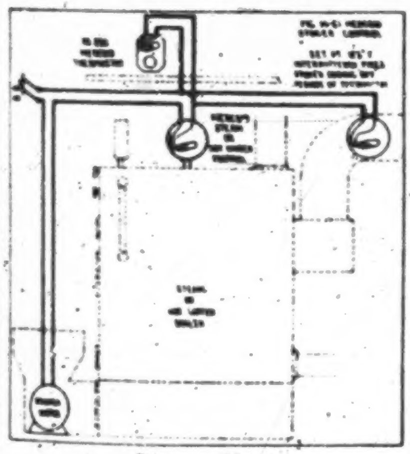


Diagram No. 1

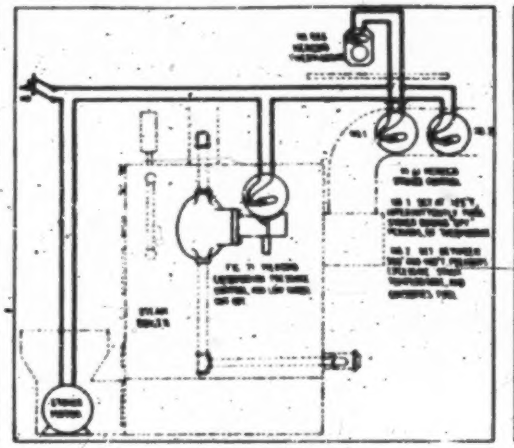


Diagram No. 2

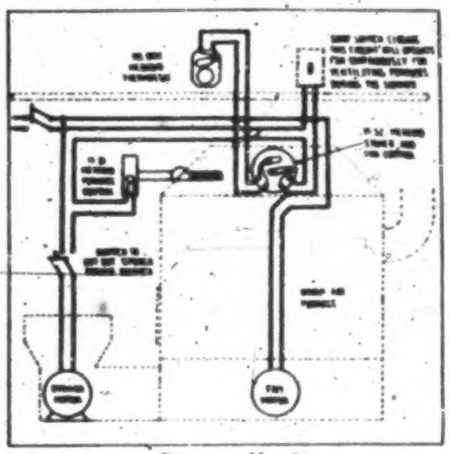


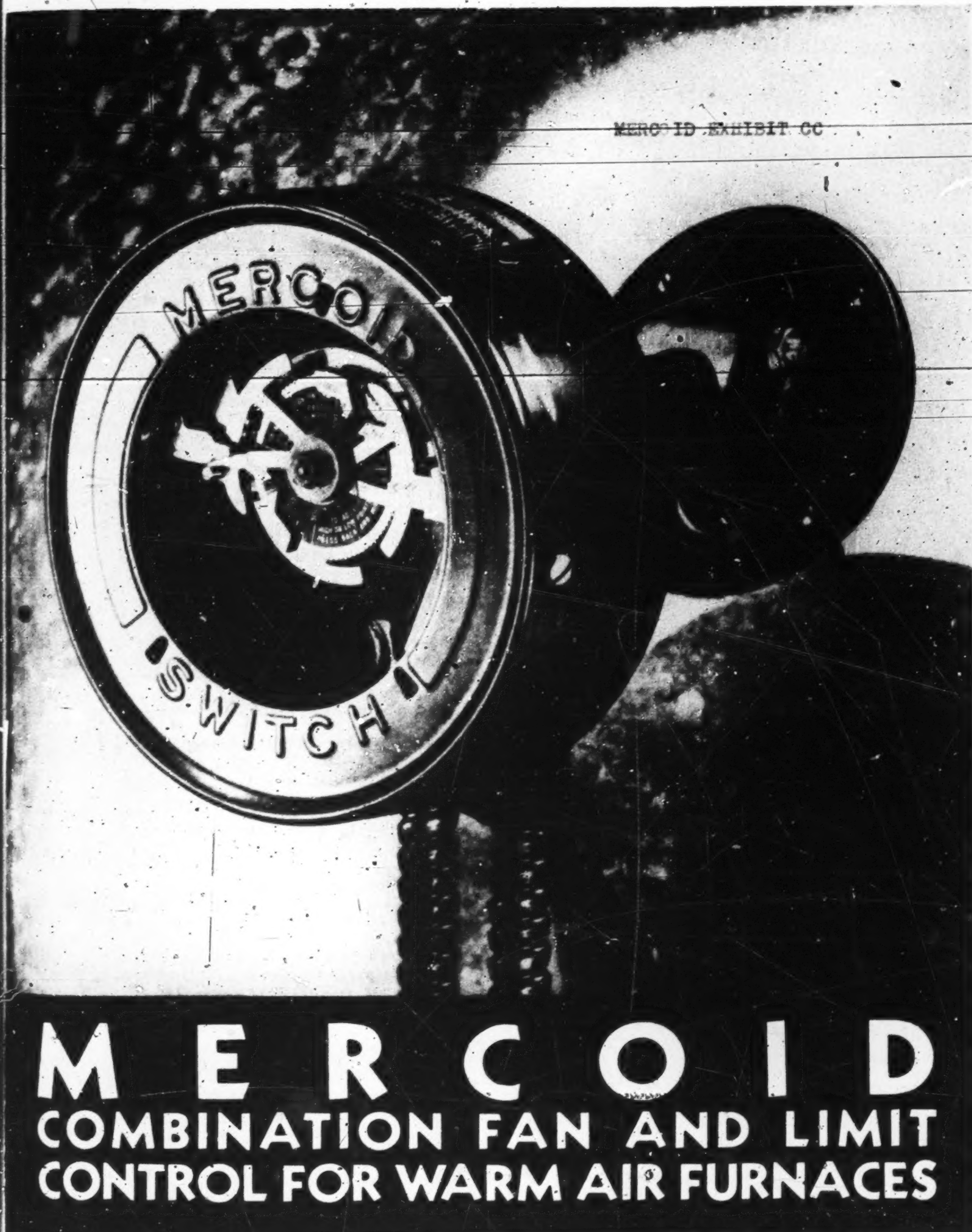
Diagram No. 3

LIST PRICES

	Single Pole	Double Pole	Two Circuit
Type M-61 Stoker Control, 10 Amp.	$18.00	$22.00	
Type M-63 Stoker Control, 10 Amp.	18.00	22.00	
Type M-51 Furnace Control, 10 Amp.	18.00	22.00	
Type M-52 Furnace Control, 10 Amp.			$22.00

Shipping Weight, 4 lbs., 14 oz.

MERCOID EXHIBIT CC



MERCOID COMBINATION FAN AND LIMIT CONTROL

Heretofore all automatically fired warm air furnaces equipped with a fan or blower, required two separate Mercoid Controls, but these controls may now be had in a single unit in the Mercoid Combination Fan and Limit Control, at a saving over the use of two instruments.

Why a Limit Control is Necessary

The function of a limit control is to protect the furnace from overheating. For example, if the thermostat should be subjected to a cold draft of air from an open window or door, it would cause the electrical circuit of the thermostat to remain closed and continue to call for heat until the cold draft is removed. In the meantime, the oil burner, stoker or gas burner (whatever the case may be) would operate at capacity and very likely result in overheating the furnace, but for the interception of the limit control, which is set at a high predetermined temperature to stop the operation of the heating equipment under such circumstances. However, as soon as the temperature drops to the low predetermined setting of the limit control, the burner will start again, and in this respect, the limit control functions as a thermostat until the abnormal condition surrounding the thermostat is corrected.

The Use of a Fan or Blower Control

The other control, widely used on warm air furnaces, is a fan or blower control, which regulates the operation of a fan or blower.

It is a fact that equipping a warm air furnace with a fan or blower increases the efficiency of the furnace and also economizes on fuel. That is why blower equipped furnaces are rapidly growing in popular favor. They also lend themselves to cooling or air conditioning applications during hot weather. For this type of application, the Mercoid Fan Control has been the accepted control by the trade.

Features of the Mercoid Combination Control

The Mercoid Combination Fan and Limit Control retains all of the outstanding features of the Mercoid Type M-53 Fan Control and Type M-51 Limit Control.

Temperature Indicating Dial

It has a red dial in plain view located at the center of the instrument. The dial is calibrated in Fahrenheit degrees with a scale in duplicate—one scale to each side of the dial. A temperature indicating pointer is provided for each scale to facilitate the reading of the temperature in the furnace hood or duct.

Being able to readily determine the duct temperature has proven to be a popular feature on Mercoid Furnace Controls. It serves the same purpose as a thermometer on boilers. This information enables one to check the proper size of the furnace fire and facilitates making necessary adjustments.

Simplified Double Adjustments

Both "high" and "low" adjustment levers are provided with pointers, which plainly show the operating settings of the fan and limit contol. All adjustments are easily made by simply pressing the finger on the respective levers and moving them to the desired setting as shown in Illustrations No. 1 and No. 2. As the finger is released, the

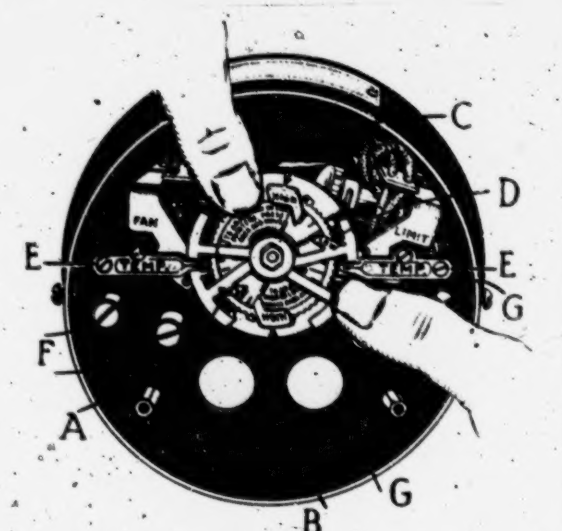


Illustration No. 1
Above illustration shows the detail construction of the control more clearly and the manner the operating adjustments are made. "A" and "B" are the adjustment levers for the fan switch to the left. "C" and "D" for the limit switch to the right. "E-E" temperature indicating pointers. "F" wiring terminals for fan switch. "G" wiring terminals for limit switch. The insulating shield which must be replaced after connections are made is not shown above.

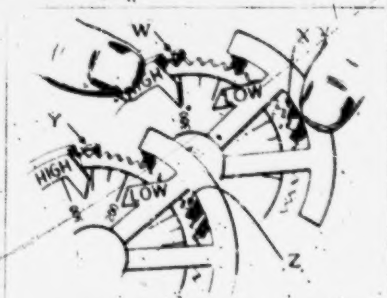


Illustration No. 2
This picture is a detailed illustration showing how the respective high and low adjustment prongs "W" and "X" are released from the tooth wheel while pressing adjustments to move them to the required setting. "Y" and "Z" show how they automatically go back into the locking position.

setting is automatically locked in the tooth wheel as shown in Illustration No. 2.

Each lever adjustment is plainly marked, thereby eliminating any possible confusion when setting the operating temperatures for both the fan and limit switches in this control.

Mercury Contact Switches Used

An important consideration when selecting an automatic control is to note the type of switch used. The "making" and "breaking" of an electrical circuit of any control, must be positive to insure trouble-free performance, otherwise, it defeats its own purpose.

Fig. [illegible]
Type of Switch used in Mercoid Combination Fan and Limit Control

There are two hermetically sealed mercury switches used in the Mercoid Combination Control. The one located on the left side, is the fan switch, while the one to the right, is the switch for the limit control.

Mercoid Switches have a number of patented features, which make them outstanding in mercury switch construction. The utmost care and skill are exercised in the making of these switches. Selected material of given specifications must be used throughout. It is amazing to see the amount of detailed attention, operations, tests and inspections that Mercoid Switches are subjected to before they become a working part of a Mercoid Control.

Mercoid Switches cannot be affected by dust, dirt or corrosive gases. They are immune to any adverse surrounding conditions. Millions of these switches have been in the field over a long period of years and are working as perfect today, as when first installed. No cleaning of contacts, or other attention is ever required. There can be no open arcing, pitting of contacts, oxidation or deterioration.

Mercoid Switches are "built to endure," insuring reliable service indefinitely.

Adjustable Mounting Flange

Warm air furnaces usually have a sloping hood which is a characteristic construction, however there is a tendency towards straight-line jacket design in many of the present day types.

All instruments must be placed in a level position to insure proper operation. After a suitable location is determined according to the various field conditions, as shown in Illustration No. 3, a small hole, large enough to permit the insertion of the bimetal stem of the instrument, is cut into the sloped side of the hood.

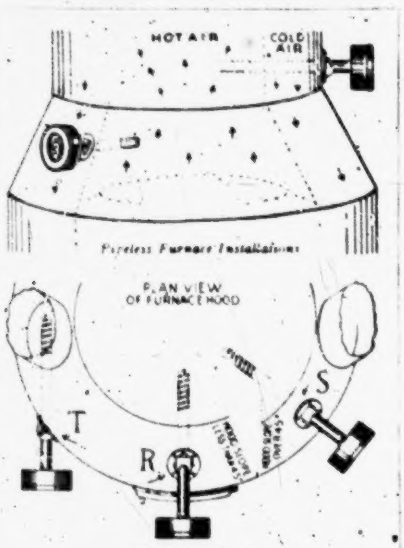


Illustration No. 3
The illustration above shows the flexibility of the adjustable flange in adapting the control to varying installation requirements. "T" shows a mounting where external obstructions do not permit it to be placed in a radius from the center as showing with "R" and "S" which position is the usual practice.

Illustration No. 4
"K" Flange Bolt. "L" Instrument Stem
"N" Revolving Clamp. "O" Locking Nut.
"P" Flange Bracket

The Mercoid Combination Fan and Limit Control is provided as standard with a special adjustable mounting flange, which makes it very easy to mount the control within a 30 to 90° angle and then lock it in a fixed position by means of a locking nut. See illustration No. 4.

Flat flange for mounting control on a flat surface and curved flanges for curved surfaces are available on order.

Control Operation

The method of operation of the Mercoid Combination Control is positive, simple and dependable.

The instrument is actuated by means of a helix shaped bimetal coil, which is constant in action, durable in construction and yet very sensitive in its response to temperature changes taking place in the furnace hood.

This bimetal coil serves a two-fold purpose by operating the control mechanism and giving an accurate furnace temperature reading on the dial of the instrument.

A rising temperature rotates the coil in one direction while a dropping temperature rotates it the opposite way. The end of the bimetal is fastened to a shaft, which turns with the coil and operates cams that throw the switches in the "off" and "on" position according to the predetermined settings of the control.

When the temperatures go beyond the control setting, the coil is permitted to turn freely without any strain on the bimetal, therefore, assuring accurate control performance over a long period of time.

Mercoid Fan and Limit Controls are sturdy in construction, compact and neat in appearance, easy to install and adjust. They give complete all around satisfaction.

Special Requirements Available on Order

In localities where there are ordinances with certain temperature limiting codes that must be complied with, we can furnish stops on the dial, which prevent the adjustment from being set above the specified temperature limitation.

Certain localities require a barrier on a combinatio control, to keep the high voltage wiring connection sep arated from the low voltage wires, where both low ar high voltage wires come into the same instrument as ma be the case when the control is used with a fan and dampe motor. The barrier may be applied in the field, and is available upon order.

The Mercoid Combination Fan and Limit Control is available in two different ranges, each having a separate type number as shown in the following illustrations:

The illustration above shows dial with range from 50—300° as used on Type M-80

The illustration above shows dial with range from 50—225° as used on Type M-82

List Price

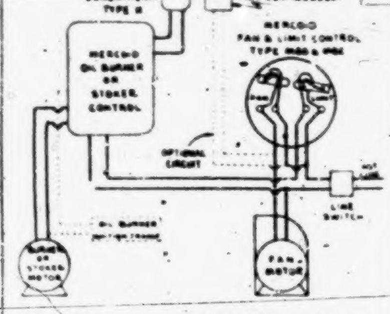
Both instruments are standard for either A.C. or D.C. 10 amp. 110V., 4 amp. 220V., motor rating 1 H.P. Repulsion-Induction. ½ H.P. D.C. 110 or 220V., D.C. and ½ H.P. split phase.

Type M-80	Range 50—300° F.	15.00
Type M-82	Range 50—225° F.	16.00

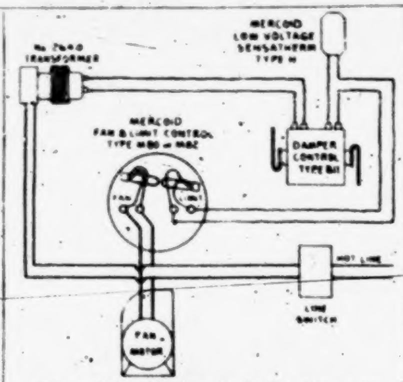
Shipping weight approximately 6 lbs.

Wiring Diagrams shown on next page

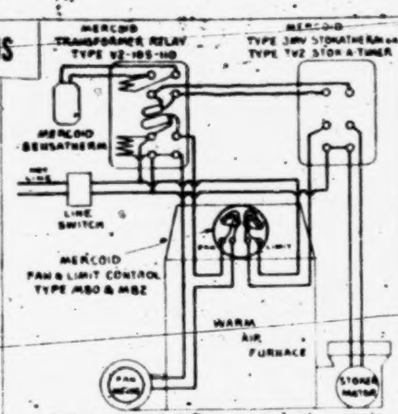
COMBINATION CONTROL WIRING DIAGRAMS



Fan hook-up in connection with oil or stoker fired warm air furnace. Closing optional circuit operates fan continuously for ventilating purposes during summer.
With this hook-up after the thermostat is satisfied, the fan will continue to run until temperature in the furnace bonnet drops to the control setting.



Showing electrical hook-up for hand fired warm air system employing circulating fan and thermostatically operated damper control.



Stokatherm or Stok-A-Timer control of a single phase stoker and circulating fan motors on warm air system. When Sensatherm calls for heat stoker starts but fan can start only after furnace is heated. When room is at required temperature, Sensatherm circuit opens which immediately stops both fan and stoker motor.

OTHER MERCOID CONTROLS FOR VARIOUS WARM AIR FURNACE APPLICATIONS


SENSATHERM


DAMPER CONTROL

Whethor a warm air furnace has a motor driven damper regulator, automatic oil burner, stoker, or gas burner, a thermostat is used in common on all of the above types of automatic heating equipment.

It is the purpose of the thermostat to stop and start the heating plant in order to maintain an even room temperature in accordance with the setting of the instrument. In this respect, the thermostat is the master control of the heating system and should be selected with care and discrimination, to assure uninterrupted comfort in the home.

The Mercoid Sensatherm meets the most exacting requirements of a room thermostat as it is extremely sensitive and requires no artificial acceleration to keep the home uniformly heated.

It is small in size, neat in appearance and mechanically perfect. The mercury switch used in this temperature control is a positive protection against contact trouble and will operate indefinitely without trouble.

In design and finish, the Sensatherm harmonizes with any scheme of interior decoration.

MERCOID DAMPER CONTROL SETS

The Mercoid Damper Control is designed for reliable automatic regulation of draft and check dampers of heating plants, and is especially recommended for operating duct dampers of zone controlled air conditioning systems.

The popular standard set consists of: Type H Sensatherm, B-11 Damper Control, 110V., 50-60 cycle Transformer and a complete set of accessories ready for installation. Other sets available.


LIMIT CONTROL


FAN CONTROL

SEPARATE LIMIT OR FAN CONTROLS

The Type M-53 Mercoid Fan Control is very popular with the warm air heating trade. Thousands of these controls are in use, giving satisfactory service. This control has a dial and pointer, which plainly indicates the temperature in the furnace hood. It is equipped with a dust-proof sealed mercury contact switch to insure dependable operation at all times. The "high" and "low" operating adjustments are easy to make.

A flange is provided to facilitate installations on different hood angles.

The Mercoid Type M-51 Limit Control has all of the outstanding features of the fan control.


TYPE KMI


TYPE KM

WHERE OIL BURNERS ARE USED

Warm air furnaces automatically fired by an oil burner, require the addition of a safety control to provide protection against flame or ignition failure. The Mercoid KM and KMI Pyratherms are tried and proven safety controls, constructed to give positive protection under all operating conditions. In event of any abnormal conditions, these controls always check to the safe side and stop the burner. Provisions are also made for low voltage protection. These controls are equipped throughout with sealed mercury contact switches to insure years of dependable service. Type KMI (illustration to the left) is for use on burners employing intermittent ignition. Type KM (illustrated to right) is for use on burners with constant ignition. Thousands of these controls are out in the field giving complete satisfaction under varying operating conditions.


STOKATHERM


STOK-A-TIMER

WHERE STOKERS ARE USED

Warm air furnaces fired by a coal stoker require a control to regulate and maintain a low fire while the thermostat is not calling for heat.

The Mercoid Stokatherm has features not found in other stoker controls. It does not depend upon any fixed stack temperature or fixed timing, but in maintaining the fire employs both methods in one principle of operation. The operation of the control in maintaining the fire is determined by the condition of the fire itself, thus making it possible to maintain a very low fire during this period. Overheating is prevented and fuel is economized. The Stokatherm is for use on anthracite stokers and also for stokers burning a non-coking bituminous coal. This control also has an out-fire feature which prevents feeding coal should the fire go out.

The Mercoid Stok-A-Timer is an improved timer type control and may be used on all types of stokers. It prevents the stoker from operating immediately after the thermostat shuts off. This control is extremely simple to adjust by merely moving a lever over a calibrated dial to the required setting. No tools are required.

THE MERCOID CORPORATION • General Office and Factory, 4201 BELMONT AVE., CHICAGO, ILL.

New York Office: 90 WEST STREET • *Philadelphia Office:* 3137 N. BROAD ST. • *Boston Office:* 25 IVY STREET • *Distributors in All Principal Cities*

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Bulletin M-12

INSTALLATION INSTRUCTIONS

MERCOID WARM AIR FURNACE CONTROLS

TYPES M-51, M-52, M-53, M-55, M-56, M-57

Patent Numbers 1,398,874, 1,640,869, 1,705,989, 1,758,957, 1,757,436, 1,834,288, 1,884,046. Others Pending

CAUTIONS

1. Mercoid Furnace Controls leave the factory with the bi-metallic element properly formed, heat treated, stabilized and calibrated.

DO NOT TWIST THE BI-METAL COIL as any manual twisting or bending may permanently distort it. Not only will this destroy the correct calibration of the instrument but also the accurate performance after adjustment is made. It is recommended in case of a badly distorted bi-metallic element, that the instrument be either sent back to the factory for recalibration or a new bi-metallic element ordered for replacement. In ordering element for replacement the serial number of the instrument should be supplied.

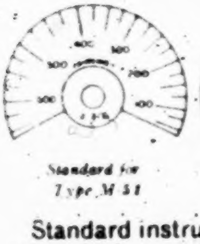
Should the temperature reading be in error due to an accidentally twisted bi-metallic element, if not excessively twisted it may be readjusted by allowing the instrument to reach room temperature, loosening the nut in the center of the dial and moving dial until correct reading is obtained, after which the nut should be tightened.

2. DO NOT OVERLOAD—Check the instrument nameplate which shows the electrical capacity in amperes, and make certain that the load to be handled is within this rating.

3. DO NOT OIL ANY PARTS—All bearings are self lubricating. Oil accumulates dirt, becomes gummy with age and heat, and interferes with the free operation of the control mechanism.

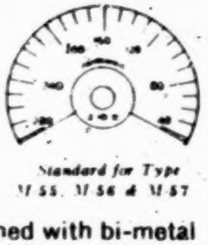
4. DO NOT OVERHEAT—At no time should the instrument be subjected to a temperature higher than the maximum shown on the nameplate or graduated scale.

STANDARD DIALS USED ON MERCOID FURNACE CONTROLS



Standard for Type M-51

Standard for Type M-52 & M-53



Standard for Type M-55, M-56 & M-57

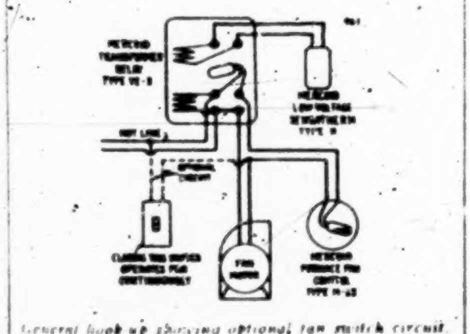
Standard instruments are furnished with bi-metal coils which operate in accordance with graduations on dials as shown.

Note that Type M-51 dial has wide graduations at the top of its range and thus gives close regulation at high temperatures. Type M-53 gives very close regulation at low temperatures but is not sensitive at high temperatures.

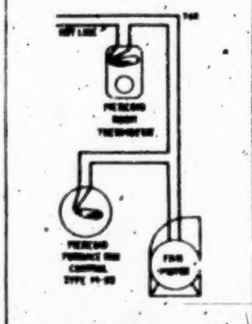
If Type M-51 is desired to give close operation at low temperatures, it can be furnished, at no extra charge, with Type M-53 coil and dial when so ordered. Type M-53 control can also be supplied with Type M-51 coil and dial to give close operation at high temperatures.

Type M-55 and M-57 dial is graduated evenly and gives extremely close regulation at any point on its range. This type instrument should be employed in place of Type M-51 or M-53 when very close operating differentials are desired, and the operating temperature is within the range of this instrument.

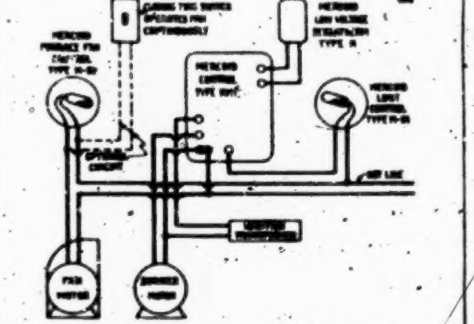
GENERAL WIRING DIAGRAMS



General hook-up showing optional fan switch circuit. By closing this circuit fan can be operated for ventilating purposes during summer. No changes of control setting are required.



Simplified hook-up where high voltage thermostat is employed.



Fan hook-up in connection with oil fired warm air furnace. Closing optional circuit operates fan continuously for ventilating purposes during summer.

(Continued on other side)

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MERCOID EXHIBIT EE

MINNEAPOLIS-HONEYWELL REGULATOR CO.

EXECUTIVE OFFICES
MINNEAPOLIS, MINNESOTA, U. S. A.

FACTORIES MINNEAPOLIS, MINN.
WABASH, IND.

SUBSIDIARIES
THE BROWN INSTRUMENT CO.
PHILADELPHIA, PA.
MINNEAPOLIS HONEYWELL REGULATOR CO. LTD.
TORONTO, CANADA
N. V. NEDERLANDSCHE
MINNEAPOLIS-HONEYWELL CO.
AMSTERDAM, HOLLAND
HONEYWELL-BROWN, LTD.
LONDON, ENGLAND
HONEYWELL-BROWN A.B.
STOCKHOLM, SWEDEN

January 24, 1940

Mr. Courteol,
The Mercoid Corp.,
4201 Belmont Ave.,
Chicago, Illinois.

Dear Mr. Courteol:

Will you please tell me whether or not you and Mr. McCabe have had an opportunity to give consideration to the matter of licensing under the Freeman Patent along the lines which I discussed with you in Chicago last week.

Very truly yours,

MINNEAPOLIS-HONEYWELL REGULATOR CO.

W. L. Huff

WLH/s W. L. Huff, Vice-Pres. & Treasurer.

A G R E E M E N T

AGREEMENT entered into this ____ day of __________, 1940, by and between MINNEAPOLIS-HONEYWELL REGULATOR COMPANY, a corporation organized and existing under the laws of the State of Delaware and having a principal place of business at Minneapolis, Minnesota, hereinafter called "Licensor" and ______________, a corporation organized and existing under the laws of the State of ______________, and having a principal place of business at ______________, hereinafter called "Licensee",

W I T N E S S E T H:

WHEREAS, Licensor is the owner of United States Letters Patent No. 1,813,732 granted to Edward E. Freeman on July 7, 1931; and

WHEREAS, Licensee is desirous of obtaining a certain non-exclusive license and right under said Freeman Patent No. 1,813,732;

NOW, THEREFORE, in consideration of the sum of One Dollar ($1.00) paid to the Licensor by Licensee, the receipt of which is hereby acknowledged and in consideration of the mutual representations, covenants and agreements herein set out, Licensor and Licensee mutually represent, covenant and agree as follows:

1. Definition of Combination Furnace Control

As used in this agreement, the expression "Combination Furnace Control" shall mean a unitary structure including at least a switching means for controlling not less than two circuits and operated by temperature responsive means responsive to the

temperature of a heating device or the fluid medium heated thereby, one of said circuits being established on temperature rise and another being established on temperature fall, the structure having permanent internal wiring connecting the switching means to terminals for the connection of external wires thereto, the internal wiring being so arranged that when the terminals are connected by external wires to a heat controlling mechanism or a combustion controlling mechanism for the heating device and to a means for controlling the circulation of the fluid medium heated thereby, such structure, when used as intended, embodies the system disclosed in and claimed by the Freeman patent No. 1,813,732.

II. Grant

Licensor hereby grants unto Licensee the non-exclusive right and license under said Freeman Patent No. 1,813,732 to make, use and sell said "Combination Furnace Control" throughout the United States, its territories and possessions.

Subject to the terms and conditions hereinafter set forth, Licensor additionally grants unto Licensee under said Freeman Patent No. 1,813,732 the right and license to show and describe in its advertising and other literature complete systems of control covered by said Freeman Patent, except however, if Licensee has a "Combination Furnace Control" applicable to the system shown in such literature, then the Licensee shall show said "Combination Furnace Control" as an element thereof.

III. Royalties

Licensee covenants and agrees to pay to Licensor an earned royalty of twenty-five cents (25¢) on each "Combination Furnace Control" sold by it.

"Combination Furnace Controls" shall be considered as sold when billed out, or, if not billed out, then when delivered, or when paid for if paid for before delivery; but royalties paid on "Combination Furnace Controls" not accepted by the customer or returned for credit may be credited on future royalty payments.

IV. Records and Reports

Licensee agrees to keep accurate records showing the number of "Combination Furnace Controls" sold by it during the continuance of this agreement and to render quarterly statements to Licensor on or before the fifteenth days of January, April, July and October showing the number of "Combination Furnace Controls" sold by it during the preceding three months and further agrees to accompany each such statement by payment of the royalty thereby shown to be due Licensor.

Licensor shall have the right, through a certified public accountant, to inspect the books and records of Licensee pertaining to sales of "Combination Furnace Controls" in so far as may be necessary to verify the statements provided for herein, but such inspection shall be made during business hours and not oftener than once every three months.

V. Patent Marking

Licensor and Licensee mutually agree that upon each of said "Combination Furnace Controls" sold they will place a name-plate, or a securely fastened tag or a cover insert, which name-plate, or tag or cover insert shall carry upon it, among other things, the following information in clearly legible and reasonably sized lettering or printing:

"Notice - This control is internally wired in a manner to shut down the heat source while permitting blower operation on furnace temperature rise and to stop the blower but permit operation of the heat source on temperature fall. This control and its use carries with it a license for one installation employing the sequence of operation embodying the invention of Freeman Patent No. 1,813,732."

VI. Notice on Literature

Licensor and Licensee mutually agree that they will only illustrate or describe the systems of control covered by the Freeman Patent No. 1,813,732 in their advertising, catalogues or other literature in connection with "Combination Furnace Controls" manufactured and regularly sold by them and that they will include in the copy of such literature and on the drawings or wiring diagrams thereof a statement to the following effect:

> "The Freeman Patent No. 1,813,732 covers systems of control in which upon rise in the temperature of a furnace or like heating device, the source of heat is reduced or shut down but the blower or other circulating means is permitted to operate, and in which upon fall in such temperature, the blower or other circulating device is stopped but the source of heat is permitted to heat the furnace or other heating device. This control is specially designed for carrying out the system of the Freeman Patent and its use carries with it a license for one installation employing the sequence of operation of the Freeman Patent No. 1,813,732."

VII. Price Condition

(a) The license granted herein to the Licensee is granted on the express condition that the prices, terms and conditions of sale of "Combination Furnace Controls" made in accordance with the terms of this agreement, shall be not more favorable to the customer than those fixed from time to time by Licensor for its own products embodying the invention covered by said agreement, and Licensee agrees to maintain such not more favorable prices, terms and conditions of sale as to said "Combination Furnace Controls." The prices, terms and conditions of sale shall be set forth in a schedule to be known as a "Price Schedule" and shall be issued from time to time by Licensor and form a part of this Agreement as though herein set out in full, and Licensee, after receiving a "Price Schedule" agrees that it will sell "Combination Furnace Controls" only at prices and on terms not more favorable to the customer than those set forth in said Price Schedule and in compliance with the general sales rules in said Price Schedule. A price schedule is hereto attached and marked "Price Schedule Exhibit A."

(b) Licensor shall give Licensee reasonable notice in writing of any and all proposed changes in said Price Schedule but not less than thirty (30) days' written notice shall be given before any change shall go into effect.

(c) The spirit and intent of this License Agreement contemplate that in no transaction shall there be, directly or indirectly, included any item or extra which shall have the effect of reducing the prices below those set forth in said Price Schedule as it exists from time to time as, for instance, by the inclusion in the transaction of other material or extras for

increasing the value of the "Combination Furnace Control" or parts or labor or services at the prices computed in accordance with the standard method of cost accounting used by Licensee for such extras plus the minimum price for the "Combination Furnace Control." No extras shall be included under any circumstance at a price for such extras at less than what said extras are sold at when sold with some other unit or control. Temperature indicating means to indicate the temperature at the thermal means of the "Combination Furnace Control" and a summer adjustment or locking means to provide fan operation only in the summer shall not be considered for the purpose of this agreement as an extra.

VIII. Duration and Termination

Unless earlier terminated, this agreement shall continue to the full end of the term of said Freeman Patent No. 1,813,732 and any extensions or reissues thereof.

Upon default of any of the conditions herein by Licensee, Licensor may inform the Licensee of such default in writing, and if such default be not remedied within sixty days thereafter by the Licensee, this agreement may be terminated by the Licensor at its election.

Licensee shall not have the right to terminate this agreement before the end of the calendar year 1940, but may cancel at any time thereafter by giving said Licensor a sixty (60) day notice in writing prior to the date of cancellation.

In the event Licensee does not place upon the market as one of its standard items a "Combination Furnace Control" within six months of the execution of this agreement, or if after placing such a control on the market, Licensee ceases to distribute literature and manufacture and sell the same, then,

in such event, Licensor may cancel this agreement by written notice sent to Licensee.

It is understood and agreed, that cancellation or termination of this agreement for any cause shall not relieve Licensee from the payment of any royalties which are due and owing to the Licensor at the time such cancellation or termination becomes effective.

IX. Binding Upon Successors

This agreement and the covenants herein contained shall be binding upon the successors of Licensor and Licensee but the rights granted Licensee herein shall only be assignable by Licensee in connection with the sale of its entire business relating to the temperature control field.

X. Acknowledgment of Validity

Licensee agrees to and does hereby acknowledge, during the life of this Agreement, the validity of said Freeman Patent No. 1,813,732 under which this license is granted and agrees, during the life of this Agreement, that it will not deny or contest its validity or aid others in so doing.

XI. Equality of Terms

Licensor hereby covenants and agrees that in the event it grants to another party a license similar in tenor and scope and having more favorable terms than this Agreement, then in such event, Licensor will and hereby does extend to Licensee the same more favorable terms in this Agreement.

XII. No Other Rights Granted

It is mutually understood and agreed that Licensee receives no licenses or right whatsoever under any other patents or applications owned or controlled by Licensor or under which

Licensor has the right to grant Licenses and rights, and that the limited license and rights hereby granted unto Licensee under the Freeman Patent No. 1,813,732 constitute the only license and rights which Licensee receives hereunder, impliedly or otherwise.

XIII. Waiver for Past Infringement

Licensor hereby waives any and all claims that it may have against Licensee for past infringement of said Freeman Patent No. 1,813,732.

IN WITNESS WHEREOF, the parties hereto have duly caused this instrument to be executed by their proper officers thereunto duly authorized on the day and year first above written.

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

By ______________________

Attest:

____
Secretary.

By ______________________

Attest:

____
Secretary.

PRICE SCHEDULE - EXHIBIT A

Price Schedule forming a part of license agreement involving Freeman Patent No. 1,813,732.

MANUFACTURER

A manufacturer shall be defined as any firm manufacturing and marketing equipment with which Combination Furnace Controls are sold as an original part of, or necessary accessory to their product.

Manufacturer's Price

The net minimum price for a Combination Furnace Control shall be . . . . $ 5.25

The net minimum price for a Combination Furnace Control including a summer switch (manually operable on and off switch for the fan) shall be 5.65

The net minimum price for a Combination Furnace Control operable at two speeds shall be 7.50

The net minimum price for a Combination Furnace Control operable at two speeds including a summer switch (manually operable on and off switch for the fan) shall be 7.90

JOBBER AND WHOLESALER

A jobber or wholesaler shall be defined as a firm that handles Combination Furnace Controls primarily for the purpose of resale to contractors and dealers.

Jobber's or Wholesaler's Price

The net minimum price for a Combination Furnace Control shall be	6.19
The net minimum price for a Combination Furnace Control including a summer switch (manually operable on and off switch for the fan) shall be	6.75
The net minimum price for a Combination Furnace Control operable at two speeds shall be	9.00
The net minimum price for a Combination Furnace Control operable at two speeds including a summer switch (manually operable on and off switch for the fan) shall be	9.56

DEALERS AND OTHERS

Dealers and others shall be defined as all classes of customers not specifically coming within either the classification of a manufacturer or a jobber or a wholesaler as herein defined.

Dealer's and Others' Price

The net minimum price for a Combination Furnace Control shall be 7.84

The net minimum price for a Combination Furnace Control including a summer switch (manually operable on and off switch for the fan) shall be 8.55

The net minimum price for a Combination Furnace Control operable at two speeds shall be 11.40

The net minimum price for a Combination Furnace Control operable at two speeds including a summer switch (manually operable on and off switch for the fan) shall be 12.11

These prices shall become effective not later than thirty (30) days after the execution of the contract of which this Price Schedule forms a part.

MINNEAPOLIS-HONEYWELL REGULATOR CO.

EXECUTIVE OFFICES
MINNEAPOLIS, MINNESOTA, U. S. A.

FACTORIES MINNEAPOLIS, MINN
WABASH, IND.

W. L. HUFF
VICE PRESIDENT
AND
TREASURER

SUBSIDIARIES
THE BROWN INSTRUMENT CO
PHILADELPHIA, PA
MINNEAPOLIS-HONEYWELL REGULATOR CO LTD
TORONTO, CANADA
N. V. NEDERLANDSCHE
MINNEAPOLIS-HONEYWELL CO.
AMSTERDAM, HOLLAND
HONEYWELL-BROWN, LTD.
LONDON, ENGLAND
HONEYWELL-BROWN, A/B
STOCKHOLM, SWEDEN

May 7, 1940

Mr. C. J. Swan
Detroit Lubricator Company
5900 Trumbull Avenue
Detroit, Michigan

and

Mr. Ira E. McCabe
Mercoid Corporation
4201 West Belmont Avenue
Chicago, Illinois

Gentlemen:

In connection with the printed form of licensing agreement which I handed to you in Chicago last week I should at the same time have furnished you with copies of the attached letters, both of which have become a part of this agreement in the cases where licenses have been granted, and these same conditions would apply in connection with any new licenses issued.

Very truly yours,

MINNEAPOLIS-HONEYWELL REGULATOR CO.

W. L. Huff (R)

W. L. Huff, Vice-President & Treasurer

WLH/r
Enc.

Gentlemen:

With reference to the license agreement this day entered into between and Minneapolis-Honeywell Regulator Company under Freeman Patent No. 1,813,732, it is our understanding that Paragraph VI entitled "Notice on Literature" does not place any restriction either on or Minneapolis-Honeywell Regulator Company on showing and describing in their respective advertising literature separate controls for use in a Freeman patented system if the company showing such separate controls does not have a "Combination Furnace Control" applicable to the system shown in such literature.

Yours very truly,

MINNEAPOLIS-HONEYWELL REGULATOR CO.

By ______________________
President.

Signed

We are in accord with the above interpretation of Paragraph VI entitled "Notice on Literature".

By ______________________

In connection with our license agreement to you under the Freeman Patent No. 1,513,732, we agree that so long as you do not sell separate heating medium temperature responsive controls for carrying out the system of the Freeman patent at a combined price which is less than 25% higher than the prices set forth in the Price Schedule of the agreement for any specific "Combination Furnace Control" comparable to carrying out in operation and function what the separate controls would do, we will not assert our rights against you or your customers under the Freeman Patent on account of such sales.

Yours very truly,

H. W. Sweatt - President.

UNSigned

License Agreement

Between

Minneapolis-Honeywell Regulator Company

and

MERCOID EXHIBIT JJ

AGREEMENT.

Agreement, entered into this .... day of ...., 194...., by and between **MINNEAPOLIS-HONEYWELL REGULATOR COMPANY**, a corporation organized and existing under the laws of the State of Delaware and having a principal place of business at Minneapolis, Minnesota, hereinafter called "Licensor", and ...., a corporation organized and existing under the laws of the State of ...., and having a principal place of business at ...., ..., hereinafter called "Licensee";

Witnesseth:

Whereas, Licensor is the owner of United States Letters Patent No. 1,813,732 granted to Edward E. Freeman on July 7, 1931; and

Whereas, Licensee is desirous of obtaining a certain non-exclusive license and right under said Freeman Patent No. 1,813,732;

Now, therefore, in consideration of the sum of One Dollar ($1.00) paid to the Licensor by Licensee, the receipt of which is hereby acknowledged and in consideration of the mutual representations, covenants and agreements herein set out, Licensor and Licensee mutually represent, covenant and agree as follows:

I. Definition of Combination Furnace Control.

As used in this agreement, the expression "Combination Furnace Control" shall mean a unitary structure including at least a switching means for controlling not less than two circuits and operated by temperature responsive means responsive to the temperature of a heating device or the fluid medium heated thereby, one of said circuits being established on temperature rise and another being established on temperature fall, the structure having permanent internal wiring connecting the switching means to terminals for the connection of

external wires thereto, the internal wiring being so arranged that when the terminals are connected by external wires to a heat controlling mechanism or a combustion controlling mechanism for the heating device and to a means for controlling the circulation of the fluid medium heated thereby, such structure, when used as intended, embodies the system disclosed ~~in and claimed~~ by the Freeman patent No. 1,813,732. It being understood that this definition is not intended so far as said Freeman Patent is involved to limit the combinations in or with which said "Combination Furnace Control" may be used by Licensee or its vendees.

II. Grant.

Licensor hereby grants unto Licensee the non-exclusive right and license under said Freeman Patent No. 1,813,732 to make, use and sell said "Combination Furnace Control" throughout the United States, its territories and possessions, and to make and sell without any of the limitations or restrictions herein contained to any and all persons, firms or corporations, holding a license similar in scope to the license herein granted.

Subject to the terms and conditions hereinafter set forth, Licensor additionally grants unto Licensee under said Freeman Patent No. 1,813,732 the right and license to show and describe in its advertising and other literature complete systems of control covered by said Freeman Patent, except however, if Licensee has a "Combination Furnace Control" applicable to the system shown in such literature, then the Licensee shall show said "Combination Furnace Control" as an element thereof.

III. Royalties.

Licensee covenants and agrees to pay to Licensor an earned royalty of twenty-five cents (25¢) on each "Combination Furnace Control" sold by it.

For the sole purpose for computing royalty payments, "Combination

Furnace Controls" shall be considered as sold when billed out, or, if not billed out, then when delivered, or when paid for if paid for before delivery; but royalties paid on "Combination Furnace Controls" not accepted by the customer or returned for credit may be credited on future royalty payments.

IV. Records and Reports.

Licensee agrees to keep accurate records showing the number of "Combination Furnace Controls" sold by it during the continuance of this agreement and to render quarterly statements to Licensor on or before the fifteenth days of January, April, July and October showing the number of "Combination Furnace Controls" sold by it during the preceding three (3) months and further agrees to accompany each such statement by payment of the royalty thereby shown to be due Licensor.

Licensor shall have the right, through a certified public accountant, to inspect the books and records of Licensee pertaining to sales of "Combination Furnace Controls" in so far as may be necessary to verify the statements provided for herein, but such inspection shall be made during business hours and not oftener than once every three (3) months.

The certified public accountant making such inspection as herein provided for shall be agreeable to the Licensee and shall report to the Licensor the accuracy of the statements rendered by the Licensee from time to time. It is the intent of the Licensor and Licensee that the certified public accountant shall not disclose to the Licensor any business details which he may find in the Licensee's books while making such inspection and which are not necessary in determining the accuracy of the reports rendered by Licensee to Licensor.

V. Patent Marking.

Licensor and Licensee mutually agree that upon each of said "Combination Furnace Controls" sold they will place a nameplate, or a securely fastened tag or a cover insert, which nameplate, or tag or

cover insert shall carry upon it, among other things, the following information in clearly legible and reasonably sized lettering or printing:

> "Notice—This control is internally wired in a manner to shut down the heat source while permitting blower operation on furnace temperature rise and to stop the blower but permit operation of the heat source on temperature fall. This control and its use carries with it a license for one installation employing the sequence of operation embodying the invention of Freeman Patent No. 1,813,732."

VI. Notice on Literature.

Licensor and Licensee mutually agree that they will illustrate or describe the systems of control covered by the Freeman Patent No. 1,813,732 in their catalogues and installation literature only in connection with "Combination Furnace Controls" manufactured and regularly sold by them and that they will include in the copy of such literature and on the drawings or wiring diagrams thereof a statement to the following effect:

> "The Freeman Patent No. 1,813,732 covers systems of control in which upon rise in the temperature of a furnace or like heating device, the source of heat is reduced or shut down but the blower or other circulating means is permitted to operate, and in which upon fall in such temperature, the blower or other circulating device is stopped but the source of heat is permitted to heat the furnace or other heating device. This control is specially designed for carrying out the system of the Freeman Patent and its use carries with it a license for one installation employing the sequence of operation of the Freeman Patent No. 1,813,732."

Provided, however, that Licensee may distribute all catalogues and installation literature relating to said "Combination Furnace Controls" it may now have on hand and that in the event this agreement is terminated, Licensee shall have the right to continue to use said catalogues and literature it may have on hand at the termination of the agreement until the supply thereof is exhausted.

VII. Price Condition.

(a) The license granted herein to the Licensee is granted on the express condition that the prices, terms and conditions of sale of "Combination Furnace Controls" made in accordance with the terms of this agreement, shall be not more favorable to the customer than those fixed from time to time by Licensor for its own products embodying the invention covered by said agreement, and Licensee agrees to maintain such not more favorable prices, terms and conditions of sale as to said "Combination Furnace Controls." The prices, terms and conditions of sale shall be set forth in a schedule to be known as a "Price Schedule" and shall be issued from time to time by Licensor and form a part of this Agreement as though herein set out in full, and Licensee, after receiving a "Price Schedule" agrees that it will sell "Combination Furnace Controls" only at prices and on terms not more favorable to the customer than those set forth in said Price Schedule and in compliance with the general sales rules in said Price Schedule. A price schedule is hereto attached and marked "Price Schedule Exhibit A."

(b) Licensor shall give Licensee reasonable notice in writing of any and all proposed changes in said Price Schedule but not less than thirty (30) days' written notice shall be given before any change shall go into effect, and no such change shall operate against a bona fide order for "Combination Furnace Controls" to be delivered after the said change in price goes into effect, except that in no case shall delivery upon said bona fide order be made later than eleven (11) months after the change in price is effective.

(c) The spirit and intent of this license agreement contemplate that in no transaction shall there be, directly or indirectly, included any item or extra which shall have the effect of reducing the prices below those set forth in said Price Schedule as it exists from time to time as, for instance, by the inclusion in the transaction of other material or extras for increasing the value of the "Combination Furnace Control" or parts or labor or services at the prices computed in accord-

ance with the standard method of cost accounting used by Licensee for such extras plus the minimum price for the "Combination Furnace Control." No extras shall be included under any circumstance at a price for such extras at less than what said extras are sold at when sold with some other unit or control. Temperature indicating means to indicate the temperature at the thermal means of the "Combination Furnace Control" and a summer adjustment or locking means to provide fan operation only in the summer shall not be considered for the purpose of this agreement as an extra, nor shall size or shape of sensitive element, the addition of mounting fittings or the addition of an auxiliary terminal adaptor panel for converting a two wire installation into a three wire installation or vice versa be considered an extra for the purpose of this agreement.

VIII. Duration and Termination.

Unless earlier terminated, this agreement shall continue to the full end of the term of said Freeman Patent No. 1,813,732 and any extensions or reissues thereof.

Upon default of any of the conditions herein by Licensee, Licensor may inform the Licensee of such default in writing, and if such default be not remedied within sixty days thereafter by the Licensee, this agreement may be terminated by the Licensor at its election.

Licensee shall not have the right to terminate this agreement before the end of the calendar year 1940, but may cancel at any time thereafter by giving said Licensor a sixty (60) day notice in writing prior to the date of cancellation.

In the event Licensee does not place upon the market as one of its standard items a "Combination Furnace Control" within six (6) months of the execution of this agreement, or if after placing such a control on the market, Licensee ceases to distribute literature and manufacture and/or sell the same, then, in such event, Licensor may cancel this agreement by written notice sent to Licensee.

It is understood and agreed, that cancellation or termination of this agreement for any cause shall not relieve Licensee from the payment of any royalties which are due and owing to the Licensor at the time such cancellation or termination becomes effective.

IX. Binding Upon Successors.

This agreement and the covenants herein contained shall be binding upon the successors of Licensor and Licensee but the rights granted Licensee herein shall only be assignable by Licensee in connection with the sale of its entire business relating to the temperature control field.

X. Acknowledgment of Validity.

Licensee agrees to and does hereby acknowledge, during the life of this agreement, the validity of said Freeman Patent No. 1,813,732 under which this license is granted and agrees, during the life of this Agreement, that it will not deny or contest its validity or aid others in so doing.

Upon termination of this agreement, provided Licensee has complied with its obligations under the agreement up to the date of cancellation, the parties thereafter shall be in the same conditon as though this agreement had never been entered into.

XI. Equality of Terms.

Licensor hereby covenants and agrees that in the event it grants to another party a license similar in tenor and scope and having more favorable terms than this agreement, then in such event, Licensor will and hereby does extend to Licensee the same more favorable terms in this agreement. In the event of any additional granting of licenses or any change in any present Licensee's agreement, the Licensee herein shall be immediately notified of such additional license or change.

XII. No Other Rights Granted.

It is mutually understood and agreed that Licensee receives no licenses or right whatsoever under any other patents or applications owned or controlled by Licensor or under which Licensor has the right to grant licenses and rights, and that the limited license and rights hereby granted unto Licensee under the Freeman Patent No. 1,813,732 constitute the only license and rights which Licensee receives hereunder, impliedly or otherwise.

XIII. Waiver for Past Infringement.

Licensor hereby waives any and all claims that it may have against Licensee for past infringement of said Freeman Patent No. 1,813,732.

In witness whereof, the parties hereto have duly caused this instrument to be executed by their proper officers thereunto duly authorized on the day and year first above written.

Minneapolis-Honeywell Regulator Company,

By ....

Attest:

....

....

By ....

Attest:

....

9

State of Minnesota, }
County of Hennepin. } ss.

On this .... day of ...., 194...., personally appeared before me, a Notary Public in and for the above mentioned County and State .... and ...., personally known to me, who being by me duly sworn, on oath stated that they are President and Secretary, respectively, of Minneapolis-Honeywell Regulator Company; that they are authorized by the Board of Directors of said Corporation to execute the foregoing instrument; that the seal attached thereto is the seal of said Corporation, and that they executed said instrument as the free act and deed of said Corporation.

....

Notary Public.

10

STATE OF ...., } ss.
COUNTY OF .... }

On this .... day of ...., 194...., personally appeared before me, a Notary Public in and for the above mentioned County and State .... and ...., personally known to me, who being by me duly sworn, on oath stated that they are President and Secretary, respectively, of ...., that they are authorized by the Board of Directors of said Corporation to execute the foregoing instrument; that the seal attached thereto is the seal of said Corporation, and that they executed said instrument as the free act and deed of said Corporation.

....

Notary Public.

1423 MERCOID EXHIBIT KK.

Copy

AGREEMENT.

Agreement entered into this 31st day of March, 1939, by and between Minneapolis-Honeywell Regulator Company, a corporation organized and existing under the laws of the State of Delaware and having a principal place of business at Minneapolis, Minnesota, hereinafter called "Licensor" and Cook Electric Company, a corporation organized and existing under the laws of the State of Illinois, and having a principal place of business at Chicago, Illinois, hereinafter called "Licensee",

Witnesseth:

Whereas, Licensor is the owner of United States Letters Patent No. 1,813,732 granted to Edward E. Freeman on July 7, 1931; and

Whereas, Licensee is desirous of obtaining a certain non-exclusive license and right under said Freeman Patent No. 1,813,732;

Now, Therefore, in consideration of the sum of One Dollar ($1.00) paid to the Licensor by Licensee, the receipt of which is hereby acknowledged and in consideration of the mutual representations, covenants and agreements herein set out, Licensor and Licensee mutually represent, covenant and agree as follows:

I. Definition of Combination Furnace Control

As used in this agreement, the expression "Combination Furnace Control" shall mean a unitary structure including at least a switching means for controlling not less than two circuits and operated by temperature responsive
1424 means responsive to the temperature of a heating device or the fluid medium heated thereby, one of said circuits being established on temperature rise and another being established on temperature fall, the structure having permanent internal wiring connecting the switching means to terminals for the connection of external wires thereto, the internal wiring being so arranged that when the terminals are connected by external wires to a heat controlling mechanism or a combustion controlling mechanism for the heating device and to a means for controlling the circulation of the fluid medium heated thereby, such structure, when used as intended, embodies the system disclosed in and claimed by the Freeman Patent No. 1,813,732.

II. Grant

Licensor hereby grants unto Licensee the non-exclusive right and license under said Freeman Patent No. 1,813,732 to make, use and sell said "Combination Furnace Control" throughout the United States, its territories and possessions.

Subject to the terms and conditions hereinafter set forth, Licensor additionally grants unto Licensee under said Freeman Patent No. 1,813,732 the right and license to show and describe in its advertising and other literature complete systems of control covered by said Freeman Patent, except however, if Licensee has a "Combination Furnace Control" applicable to the system shown in such literature, then the Licensee shall show said "Combination Furnace Control" as an element thereof.

III. Royalties

Licensee covenants and agrees to pay to Licensor an earned royalty of twenty-five cents (25¢) on each "Combination Furnace Control" sold by it.

1425 "Combination Furnace Controls" shall be considered as sold when billed out, or, if not billed out, then when delivered, or when paid for if paid for before delivery; but royalties paid on "Combination Furnace Controls" not accepted by the customer or returned for credit may be credited on future royalty payments.

IV. Records and Reports

Licensee agrees to keep accurate records showing the number of "Combination Furnace Controls" sold by it during the continuance of this agreement and to render quarterly statements to Licensor on or before the fifteenth days of January, April, July and October showing the number of "Combination Furnace Controls" sold by it during the preceding three months and further agrees to accompany each such statement by payment of the royalty thereby shown to be due Licensor.

Licensor shall have the right, through a certified public accountant, to inspect the books and records of Licensee pertaining to sales of "Combination Furnace Controls" in so far as may be necessary to verify the statements provided for herein, but such inspection shall be made during business hours and not oftener than once every three months.

V. Patent Marking

Licensor and Licensee mutually agree that upon each of said "Combination Furnace Controls" sold they will place a nameplate, or a securely fastened tag or a cover insert, which nameplate, or tag or cover insert shall carry upon it, among other things, the following information in clearly legible and reasonably sized lettering or printing:

1426 "Notice—This control is internally wired in a manner to shut down the heat source while permitting blower operation on furnace temperature rise and to stop the blower but permit operation of the heat source on temperature fall. This control and its use carries with it a license for one installation employing the sequence of operation embodying the invention of Freeman Patent No. 1,813,732."

VI. Notice on Literature

Licensor and Licensee mutually agree that they will only illustrate or describe the systems of control covered by the Freeman Patent No. 1,813,732 in their advertising, catalogues or other literature in connection with "Combination Furnace Controls" manufactured and regularly sold by them and that they will include in the copy of such literature and on the drawings or wiring diagrams thereof a statement to the following effect:

"The Freeman Patent No. 1,813,732 covers systems of control in which upon rise in the temperature of a furnace or like heating device, the source of heat is reduced or shut down but the blower or other circulating means is permitted to operate, and in which upon fall in such temperature, the blower or other circulating device is stopped but the source of heat is permitted to heat the furnace or other heating device. This control is specially designed for carrying out the system of the Freeman Patent and its use carries with it a license for one installation employing the sequence of operation of the Freeman Patent No. 1,813,732."

1427

VII. Price Condition

(a) The license granted herein to the Licensee is granted on the express condition that the prices, terms and conditions of sale of "Combination Furnace Controls" made in accordance with the terms of this agreement, shall be not more favorable to the customer than those fixed

from time to time by Licensor for its own products embodying the invention covered by said agreement, and Licensee agrees to maintain such not more favorable prices, terms and conditions of sale as to said "Combination Furnace Controls." The prices, terms and conditions of sale shall be set forth in a schedule to be known as a "Price Schedule" and shall be issued from time to time by Licensor and form a part of this Agreement as though herein set out in full; and Licensee, after receiving a "Price Schedule" agrees that it will sell "Combination Furnace Controls" only at prices and on terms not more favorable to the customer than those set forth in said Price Schedule and in compliance with the general sales rules in said Price Schedule. A price schedule is hereto attached and marked "Price Schedule Exhibit A."

(b) Licensor shall give Licensee reasonable notice in writing of any and all proposed changes in said Price Schedule but not less than thirty (30) days' written notice shall be given before any change shall go into effect.

(c) The spirit and intent of this License Agreement contemplate that in no transaction shall there be, directly or indirectly, included any item or extra which shall have the effect of reducing the prices below those set forth in said Price Schedule as it exists from time to time as, for instance, by the inclusion in the transaction of other material or extras for increasing the value of the "Com-
1428 bination Furnace Control" or parts or labor or serv-
ices at the prices computed in accordance with the standard method of cost accounting used by Licensee for such extras plus the minimum price for the "Combination Furnace Control." No extras shall be included under any circumstances at a price for such extras at less than what said extras are sold at when sold with some other unit or control. Temperature indicating means to indicate the temperature at the thermal means of the "Combination Furnace Control" and a summer adjustment or locking means to provide fan operation only in the summer shall not be considered for the purpose of this agreement as an extra.

VIII. Duration and Termination

Unless earlier terminated, this agreement shall continue to the full end of the term of said Freeman Patent No. 1,813,732 and any extensions or reissues thereof.

Upon default of any of the conditions herein by Licensee, Licensor may inform the Licensee of such default in writing, and if such default be not remedied within sixty days thereafter by the Licensee, this agreement may be terminated by the Licensor at its election.

Licensee shall not have the right to terminate this agreement before the end of the calendar year 1940, but may cancel at any time thereafter by giving said Licensor a sixty (60) day notice in writing prior to the date of cancellation.

In the event Licensee does not place upon the market as one of its standard items a "Combination Furnace Control" within six months of the execution of this agreement, or if after placing such a control on the market, Licensee ceases to distribute literature and manufacture and
1429 sell the same, then in such event, Licensor may cancel
this agreement by written notice sent to Licensee.

It is understood and agreed, that cancellation or termination of this agreement for any cause shall not relieve Licensee from the payment of any royalties which are due and owing to the Licensor at the time such cancellation or termination becomes effective.

IX. Binding Upon Successors.

This agreement and the covenants herein contained shall be binding upon the successors of Licensor and Licensee but the rights granted Licensee herein shall only be assignable by Licensee in connection with the sale of its entire business relating to the temperature control field.

X. Acknowledgment of Validity.

Licensee agrees to and does hereby acknowledge, during the life of this agreement, the validity of said Freeman Patent No. 1,813,732 under which this license is granted and agrees, during the life of this Agreement, that it will not deny or contest its validity or aid others in so doing.

XI. Equality of Terms.

Licensor hereby covenants and agrees that in the event it grants to another party a license similar in tenor and scope and having more favorable terms than this Agreement, then in such event, Licensor will and hereby does extend to Licensee the same more favorable terms in this Agreement.

XII. No Other Rights Granted.

It is mutually understood and agreed that Licensee receives no licenses or right whatsoever under any other patents or applications owned or controlled by Li-
1430 censor or under which Licensor has the right to grant Licenses and rights, and that the limited license and rights hereby granted unto Licensee under the Freeman Patent No. 1,813,732 constitute the only license and rights which Licensee receives hereunder, impliedly or otherwise.

XIII. Waiver for Past Infringement.

Licensor hereby waives any and all claims that it may have against Licensee for past infringement of said Freeman Patent No. 1,813,732.

In Witness Whereof, the parties hereto have duly caused this instrument to be executed by their proper officers thereunto duly authorized on the day and year first above written.

Minneapolis-Honeywell Regulator Company,
By Charles B. Sweatt,
Vice President.

Seal
Attest:
Charles C. Buckland,
Secretary.

Cook Electric Company,
By G. R. Folds,
President.

Attest:
C. E. Lundeen,
Seal Asst. Secy.

COPY

PRICE SCHEDULE - EXHIBIT A

Price Schedule forming a part of license agreement involving Freeman Patent No. 1,813,732.

MANUFACTURER

A manufacturer shall be defined as any firm manufacturing and marketing equipment with which Combination Furnace Controls are sold as an original part of, or necessary accessory to their product.

Manufacturer's Price.

The net minimum price for a Combination Furnace Control shall be . . . . $ 5.25

The net minimum price for a Combination Furnace Control including a summer switch (manually operable on and off switch for the fan) shall be 5.65

The net minimum price for a Combination Furnace Control operable at two speeds shall be 7.50

The net minimum price for a Combination Furnace Control operable at two speeds including a summer switch (manually operable on and off switch for the fan) shall be 7.90

MERCOID EXHIBIT LL

JOBBER AND WHOLESALER

A jobber or wholesaler shall be defined as a firm that handles Combination Furnace Controls primarily for the purpose of resale to contractors and dealers.

Jobber's or Wholesaler's Price

The net minimum price for a Combination Furnace Control shall be $6.19

The net minimum price for a Combination Furnace Control including a summer switch (manually operable on and off switch for the fan) shall be 6.75

The net minimum price for a Combination Furnace Control operable at two speeds shall be 9.00

The net minimum price for a Combination Furnace Control operable at two speeds including a summer switch (manually operable on and off switch for the fan) shall be 9.56

DEALERS AND OTHERS

Dealers and others shall be defined as all classes of customers not specifically coming within either the classification of a manufacturer or a jobber or a wholesaler as herein defined.

Dealers' and Others' Price

The net minimum price for a Combination Furnace Control shall be . . . . $ 7.84

The net minimum price for a Combination Furnace Control including a summer switch (manually operable on and off switch for the fan) shall be 8.55

The net minimum price for a Combination Furnace Control operable at two speeds shall be 11.40

The net minimum price for a Combination Furnace Control operable at two speeds including a summer switch (manually operable on and off switch for the fan) shall be 12.11

These prices shall become effective not later than thirty (30) days after the execution of the contract of which this Price Schedule forms a part.

J. BERNHARD THIESS
ARTHUR A. OLSON
A. T. MECKLENBURGER
WILLARD L. POLLARD
GEORGE W. HANSEN
A. ARNOLD BRAND
THORLEY VON HOLST
BERTRAM WM. COLTMAN
ALBERT H. PENDLETON
CARL MARK
ARTHUR B. SEIBOLD JR.
SIDNEY NEUMAN

B. GORDON ALLER
W. HUDSON RATHBURN
ROBERT W. POURE
BENTON A. BULL
O. BAXTER WARNER

WILBUR A. OLSON
CHESTER E. WARNER
FRED T. WILLIAMS
PATENT AGENTS

THIESS, OLSON & MECKLENBURGER

ATTORNEYS AND COUNSELORS

77 WEST WASHINGTON STREET

CHICAGO

TELEPHONE
CENTRAL [illegible]

CABLE ADDRESS [illegible]
LEGAL CODE

GENERAL PRACTICE
PATENT, TRADE MARK, COPYRIGHT [illegible]

WALTER CLYDE JONES
1898-1928
KEENE H. ADDINGTON
1898-1927
ARTHUR B. SEIBOLD
1908-1932 RETIRED

ROBERT LEWIS AMES
ASSOCIATE COUNSEL

July 1, 1941.

MERC[illegible] EXHIBIT MM

Mercoid Corporation,
4201 Belmont Avenue,
Chicago, Illinois.

Attention Mr. I. E. McCabe.

Dear Mr. McCabe:

Confirming our conversation of June 23, 1941, we call attention to U. S. Letters Patent No. 2,230,446 granted to John S. Baker February 4, 1941, and assigned to the Cook Electric Company, and the manufacture and sale of controls by you that make you liable as a contributory infringer of this patent. Specifically we call attention to the lower left-hand illustration and description on page 9 of your catalog No. 400, entitled Mercoid Automatic Controls. There may be other controls that will also result in contributory infringement, but for purposes of this notice, we refer to page 9 of said catalog. You are naturally better acquainted with what you manufacture than we are and know for what purposes your products are sold.

You are apparently laboring under an erroneous impression that the Cook Electric Company is attempting to use

this patent to obtain a limited monopoly on what you say are unpatented products. To this we do not agree. We merely say that we have been authorized to institute suit for contributory infringement in and when you make a control that is to be used or is used to practice the invention covered by this patent. As a matter of fact, the Cook Electric Company does not make controls of the type in question, nor does it offer them for sale to the trade.

Under the authorities, our client has a right to hold you for contributory infringement. See B.B. Chemical Co. v. Ellis, et al., 48 U.S.P.Q. 487 (C.C.A.1, 1941) and cases therein referred to, including the Carbice, Barber Asphalt and Ethyl Gasoline cases of the United States Supreme Court.

You ask us to point out the claims of this patent we believe you infringe. Without more comprehensive knowledge of your manufacture in this type of control, we call attention to claims 39, 40, 41, 45 to 48, incl., 54, 55, 56, 66, 67, and 68.

The scope of disclosure of this patent will also be noted by referring to claims 44, 50, 51, 52 and 53 covering summer-winter control in connection with variable capacity of operation of the blower, and claims 62, 63 and 64 covering high-low fire control.

We would appreciate your early consideration of this matter and suggest a conference next week.

Yours very truly,

THIESS, OLSON & MECKLENBURGER

By Ephraim B. Coleman

BWC:TS

MINNEAPOLIS-HONEYWELL REGULATOR CO.

EXECUTIVE OFFICES
MINNEAPOLIS, MINNESOTA, U.S.A.

FACTORIES MINNEAPOLIS, MINN
WABASH, IND.

W. L. HUFF
VICE PRESIDENT
AND
TREASURER

SUBSIDIARIES
THE BROWN INSTRUMENT CO
PHILADELPHIA, PA
MINNEAPOLIS-HONEYWELL REGULATOR CO LTD,
TORONTO, CANADA
N. V. NEDERLANDSCHE
MINNEAPOLIS-HONEYWELL CO
AMSTERDAM, HOLLAND
HONEYWELL-BROWN, LTD
LONDON, ENGLAND
HONEYWELL-BROWN, SA
STOCKHOLM, SWEDEN

June 21, 1940

Mr. Ira E. McCabe
Mercoid Corporation
4201 West Belmont Avenue
Chicago, Illinois

Dear Ira:

The question of your company taking a license under the Freeman Patent has been dragging along, as you know, over a period of several months. In view of your failure to reach a decision on the matter, we have no choice but to enter suit, and this we expect to do on July 1st. I am sure that you can appreciate our position in the situation and that every opportunity has been given to you to accept the license under this patent, and that the necessity for our filing suit is the result of the necessity to be fair to our other licensees and to ourselves in this present price situation.

Very truly yours,

MINNEAPOLIS-HONEYWELL REGULATOR CO.

W. L. Huff

W. L. Huff, Vice-Pres. & Treasurer

WLH/mr

MERCOID EXHIBIT QQ

June
Twenty-eighth
1 9 4 0

Minneapolis-Honeywell Regulator Company
Minneapolis,
Minnesota

Att'n: Mr. W. L. Huff,
Vice-President & Treasurer

Dear Mr. Huff:

Your letter of June 21, 1940 addressed to The Mercoid Corporation, attention: Mr. Ira E. McCabe, has been referred to me for acknowledgment and reply.

The reason why this matter has dragged along is that Mercoid has been loath to take a license under the Freeman Patent No. 1,813,732, because as Mercoid interprets this license, Mercoid would pay a royalty upon every patented Mercoid fan or limit control sold by it whether or not adapted by the purchaser in an installation such as described in the Freeman Furnace Control Patent. Also, under this license, Mercoid would agree to control the sale price of such Mercoid instruments, and this we have been advised is not in accordance with the law.

Furthermore, from our knowledge of the prior patents and prior public uses, Mercoid denies the validity of said Freeman Patent, and further Mercoid does not sell nor install a complete apparatus for a Furnace Control as disclosed and claimed in the said Freeman Patent. Mercoid denies that the sale of its patented fan or limit control which may be adapted for use by a purchaser in a Furnace Control as claimed in the said Freeman Patent, in any way infringes or contributes to the infringement of the said Freeman Patent No. 1,813,732.

Yours very truly,

THE MERCOID CORPORATION

H. Courteol

President

H.Courteol/G

Registered Mail

MERCOID EXHIBIT RR

MINNEAPOLIS-HONEYWELL REGULATOR CO.
EXECUTIVE OFFICES
MINNEAPOLIS, MINNESOTA, U. S. A.
FACTORIES: MINNEAPOLIS, MINN.
WABASH, IND.

L. HUFF
PRESIDENT
AND
TREASURER

SUBSIDIARIES
THE BROWN INSTRUMENT CO.
PHILADELPHIA, PA.
MINNEAPOLIS-HONEYWELL REGULATOR CO. LTD.
TORONTO, CANADA
N. V. NEDERLANDSCHE
MINNEAPOLIS-HONEYWELL CO.
AMSTERDAM, HOLLAND
HONEYWELL-BROWN LTD.
LONDON, ENGLAND
HONEYWELL-BROWN, AB
STOCKHOLM, SWEDEN

October 7, 1940

Mr. Ira E. McCabe
Mercoid Corporation
4201 Belmont Avenue
Chicago, Illinois

Dear Mr. McCabe:

It has just been called to my attention that with my letter of May 7, 1940 addressed to you a letter was enclosed having reference to certain units selling at a price "less than 25% higher than the prices set forth in the price schedule of the agreement for any specific Combination Furnace Control." I now find that the term "25%" was a typographical error. It should have been "25¢" (twenty-five cents). I regret this error.

Very truly yours,
MINNEAPOLIS-HONEYWELL REGULATOR CO.

W. L. Huff

W. L. Huff, Vice-Pres. & Treasurer

WLH/mr

MERCOID EXHIBIT 88

SAN MATEO PHONE [illegible] SAN FRANCISCO PHONE DOUGLAS 1190 PALO ALTO PHONE [illegible]

PENINSULA BURNER AND OIL CO.

[illegible] HARRISON STREET SAN FRANCISCO

January
14
1926

MERCOID
EXHIBIT
CCC

Federal Gauge Co.,
564 W. Adams Street,
Chicago.

Gentlemen:

We have just figured a hot air furnace job in which we will have to use a booster fan. This fan, in our opinion, should be a actuated by the furnace itself and should come into action after the furnace has been heated, that is to say, sometime after the fire actually starts.

The problem is, therefore, to get a furnacestat of standard voltage such as shown on page 22 of the Honeywell catalogue. If you have such an instrument, kindly send us one and we will submit it to the Architect of the job for approval.

Very truly yours,

PENINSULA BURNER & OIL CO.

By

W. L. Dreyfus
W. L. Dreyfus FH

[illegible] 56-2

Cutting in

Out

M17518

MEMBER—SAN FRANCISCO CHAMBER OF COMMERCE AND THREE CITIES CHAMBER OF COMMERCE

Peninsula Burner & Oil Co.,
Mr. W. L. Dreyfus,
865 Harrison Street,
San Francisco, Calif.,

January 19, 1926

Gentlemen:-

We have your favor of the 14th regarding a hot air furnace job hook-up with a booster fan, and would advise, that our Figure 50 furnace control as shown on Bulletin E-2 enclosed, may be used for this purpose. It will be necessary for you, however, to advise us the point at which this instrument is to cut in and start the motor, and at what point you desire it to cut out.

Immediately upon receipt of this information, we shall arrange for prompt shipment.

M17518

Yours very truly,

VICE PRESIDENT

JWO:S
Enc.

SAN FRANCISCO PHONE DOUGLAS 1166 PALO ALTO PHONE 845

PENINSULA BURNER AND OIL CO.

284 HARRISON STREET SAN FRANCISCO

January
2 3
1 9 2 5

Federal Gauge Co.,
564 W. Adams St.,
~~San Fran~~ Chicago.

M17518

Gentlemen:

Referring to our request for a control such as shown on your bulletin 32 figure 50, please be advised that it is our intention to use this instrument in connection with a booster fan and its purpose is to start the fan after the furnace has attained sufficient heat to prevent cold air being blown into the house and to stop the fan at such a time after the burner quits operating that the temperature falls so low in the furnace that it is no longer desirable to have the fan running. The writer is satisfied, after speaking with your Mr. Matthews, that your figure 50 with a reversed tube will accomplish this job, and urges that one be forwarded immediately by parcel post.

Referring back to Mr. Matthews' visit here--the concerns such as ours, remote from your factory and service, undoubtedly derive great benefit from such visits and we most heartily commend your judgement in sending him along to help us out of our troubles. Trusting that we will from time to time be further favored with visits from your factory we are

Very truly yours,

PENINSULA BURNER & OIL CO.

M17518

By

WH W. L. Dreyfus.

M17518

3/4

Peninsula Burner & Oil Co.,
Mr. [illegible] Dreyfus,
[illegible] Harrison Street,
San Francisco, Calif.

January [illegible], [illegible].

Dear Sir:

Referring to your order of January 23rd, please note that our Engineering Department recommends sending you two (2) controls, one set 200° to 140°, and the other one 250° to 300°, the first instrument to be set to cut in when the temperature in the dome of the furnace reaches 200°, and remain in contact until the temperature has dropped to 140°.

This instrument will withstand a maximum temperature of 350° without damage. At 340° the question of fire hazard arises due to the accumulation of lint and dust in the air ducts and around the registers. For that reason our Engineering Department recommends sending you the second instrument as a safety limiting device set to cut in at 250° and out at 300° which will afford protection not only for the fan controlling instrument but also against the fire hazard.

If you do not want the second instrument, please return it to us for credit.

We thank you for your specifications and appreciate your kind remarks as to our Mr. Matthews.

Yours very truly,

[illegible]

JAN 29 1926
23669
Delivered ... FEB - 1 1926
ON

THE FEDERAL GAUGE CO. **INVOICE**

MERCOID ORDER.

JAN ... 19...

FROM Peninsula Burner & Oil Co.,
805 Harrison St.,
San Francisco, Calif.

SHIP above,

Date 1-...-26

Cust. Ord. No. L-1-2...-26
and L-1-14-26

Cust. Req. No. M17518

Our Ord. No.

VIA cheapest way MARK PACKAGE

1 3P Furnace control, 200-1400
LC OB HR. for Booster fan.

1 3P Furnace control, 200-3000
LC OB HR.

prom. 2-3-26

INVOICED
FEB 1 1926
NO.

postage $1.24

[illegible] SECOND STREET TELEPHONE TWO EIGHT TWO THREE

MILLER AUTOMATIC SERVICES

DOMESTIC AND COMMERCIAL

Oil Heating, Water Softening and Electric Refrigeration

FOND DU LAC, WISCONSIN

10/20

October 1[illegible], 193[illegible]

MERCOID EXHIBIT DDD

General Gauge Company
[illegible] West Adams Street
Chicago, Illinois

Gentlemen:

We have in mind an oil fired hot air job in a church which uses a blower system to force the hot air into the church.

The blower is equipped with a 220 volt, 2 phase, 2 horse power motor. We would like to equip this job with an air-stat in the top of the furnace so that the blower would automatically start when the temperature got up to a certain point and would automatically stop when the temperature in the hot air duct dropped to a pre-determined point.

If you can furnish us such equipment, please advise us and quote us prices.

Yours very truly,

MILLER AUTOMATIC SERVICES

BY [illegible]

[illegible]:LC

Miller Automatic Services,
Mr. Ralph E. Miller,
Seventeen East Second St.,
Fond Du Lac, Wisconsin.

October 20, 1926

Gentlemen:-

We have your favor of the 18th and are pleased to enclose copy of our Bulletin E-8, and would advice, that we are in a position to furnish our Figure 80 furnace control, set to cut in at 130°, and capable of withstanding a temperature of 300°, and to cut out at 140°, for use in connection with a starting switch to operate the blower motor, in the event that this motor is going to be larger than 1 H.P.

The list price of this control is $29.00, less the discount of 33-1/3%.

We would recommend, in addition to using the furnace control for starting and stopping the motor driven fan, that you employ a furnace control set to cut out at not over 300° temperature in order to protect the fan control and the installation itself from over heating.

We are in a position to make immediate shipment from Chicago stock.

We trust this gives you the desired information, and remain

Yours very truly,

J O:DS
ne.

VICE PRESIDENT

[illegible] STREET — TELEPHONE TWO EIGHT TWO THREE

MILLER AUTOMATIC SERVICES

DOMESTIC AND COMMERCIAL

Oil Heating, Water Softening and Electric Refrigeration

FOND DU LAC, WISCONSIN

November 13, 1936

General Gauge Company
164 West Adams Street
Chicago, Illinois

Gentlemen:

Please ship us one figure 50 furnace control set to cut in at 190° and cut out at 140°, this control to be capable of withstanding a temperature of [illegible]°.

These specifications are in accordance with your letter of October 20, 1936. We have gotten information from the Graybar Electric Company, and they recommend their catalog number CR7005-[illegible]4 enclosed magnetic starter for use in connection with a 1[illegible] H. P., 3 phase, 220 volt, 60 cycle motor, with [illegible] furnace control.

If you are familiar with this Graybar switch and it is not the correct one for us to use, please advise us at once.

Yours very truly,

MILLER AUTOMATIC SERVICES

BY Ralph E. Miller

ENTERED BY
DATE 11/[illegible]

[illegible] C - COB

[illegible] control
[illegible]° to 140°

[illegible] 11/15

att 11/15

9839

29.00 - 33 1/3% - 19.34
2% Cash .39
18.95

[illegible] Charge

November 23, 1926

iller Automatic Services,
nd Du Lac,
isconsin

ttention - Mr. Ralph E. Miller

ar Sirs:

In reply to your letter of November 13th, we have from e factory a promise of shipment for the 18th on the control specified in e first paragraph of your letter. While we use Figure 50 on this we ually refer to the instrument as a Booster Fan Control due to the fact at the installation is usually made for forced circulation of air in con-ction with a hot air installation. The solder used in the construction this instrument will stand up to 350° of heat and the operation of the strument is as follows:-:

When temperature surrounding the dome of a hot air in-llation reaches to 190° this control cuts in and starts the circulating , then if for any reason the fire should go out and the temperature rounding the dome be reduced to 140° or less, the instrument will cut , thus preventing the forced circulation of cold air through the ventil-ng ducts.

We usually recommend the use of a limiting device with use of the circulating fan, such as our Figure 50 Furnace Control set 250 to 300° the purpose of this being to prevent overheating of the nace dome and also due to the fact that at 340° there arises a fire haz- such as the taking fire of lint and dirt which may have accumulated in ventilating ducts. As to the necessity of this Control, you are in the t position to judge.

The magnet starter referred to in the second paragraph your letter will be entirely satisfactory for use with our control. If any time we can give you further information or blue prints or wiring grams which will be useful to you in connection with your installations, will only be too glad to forward them upon request from you, and our En-eering Department will be glad to assist you with constructive sugges-ns or in connection with any problems which may arise. We are at your vice upon request.

Yours very truly,
THE FEDERAL GAUGE COMPANY

Order Department

:VB

April 22, 1927

Premier Warm Air Heater Co.,
Dowagiac, Michigan

Attention - Mr. L. F. Coller

Dear Sirs:

In reply to your letter of April 20th perhaps an explanation of the functions of the Figure 50 Furnace Control will assist you to a better understanding of its operation. The range 250 to 300 degrees represents a safety - preventing the burner from operating to produce a temperature higher than 300 degrees surrounding the dome. At a point approximately 240 to 250 degrees Fahrenheit there arises a fire hazard due to the inflamability of lint and dust which may have collected in the air ducts. This then puts the Figure 50 in the position of a limiting device.

For forced circulation by means of booster fans we make a similarly constructed Control but instead of cutting in at the low and out at the high - the operation is just the reverse, the range being between 140 to 200 degrees. This instrument will not cut-in and start the booster fan until the temperature surrounding the dome has reached approximately 200 degrees, thus preventing the blowing of cold air through the ducts before the furnace has heated up to a point sufficient to furnish the necessary warm air. If for any reason the burner stops or the flame goes out when the temperature surrounding the dome drops to 140 degrees, this Control will cut out and stop the booster fan again preventing the blowing of cold air through the circulating ducts.

We believe this latter Control, known as the Figure 50 Booster Fan Control, will better meet your requirements. If possible, we suggest the use of both - the former as the limiting device and the latter as the fan Control. Have we made ourselves entirely clear to your satisfaction.

Yours very truly,

THE FEDERAL GAUGE COMPANY

MERCOID EXHIBIT EEE

Order Department

KRMo:VB

MERCOID EXHIBIT FFF

December 20, 1927

Socony Burner Corp.,
300 Central Ave.,
Albany, N.Y.,

Gentlemen:- Attention - Mr. R. C. Busch, Eng.

At the request of our special representative, Mr. A. W. Barr, we are enclosing copy of our heating catalog, and wish to call your attention to our Figure 50 furnace control which we are in a position to furnish with the special range for booster fan application. This control when used for this work is supplied with a range of 190 to 140°, cutting in at the high point and breaking the circuit on a drop in temperature to 140°. The expansion element or bourdon tube is capable of withstanding a maximum temperature of 350°.

We recommend in each and every instance where a booster fan control is supplied, that a regular Figure 50 furnace control be also used as a limiting device, set to cut out when the temperature in the heed above the dome reaches the temperature of 300°, restoring the circuit on a drop in temperature to 250°.

Trusting that we may have an opportunity of serving you, and thanking you for the courtesies shown our representative, we remain

Yours very truly,

JNO:DS
Encl.

VICE PRESIDENT

The XXth Century Heating & Ventilating Co.

STEAM AND HOT WATER BOILERS
REGISTERS RADIATORS AND PATENT CASING RINGS

[illegible]

REPRESENTED BY
A. D. CURRENS
PHONE 5452

124 THE DRIVE
TOPEKA, KANSAS

September 10, 1928.

The Mercoid Corporation,
Chicago, Ill.

Gentlemen:

Noticed your advertising on Furnace Control #50 in Fuel Oil under date of September 1928.

I would like to give you the following illustration of a Job which happens to be in my own home. I have an OIL-O-MATIC Burner installed as I formerly was the OIL-O-MATIC Dealer in this City and have used quite a number of various types Mercoid Controls but I have a different problem.

I have the old style burner installed which uses Minneapolis 15V Thermostat. I am using Honeywell Mercury 15V Stack switch for safety. I have often had the experience with an old thermostat of the points sticking and failing to cut off the burner, however I now have installed a new 15V. Thermostat and this may happen again. I want to eliminate extra high temperature inside the Casing in that event, and need an extra control for this purpose, and wondered if you have this #50 for this purpose to be hooked in series with the motor of the burner or on one side of the line, along with a Mercoid control which will give me control on a Miles Automatic Furnace Fan which I have installed on the [illegible]. I do not want the fan to come on as soon as the burner on account of the air feeling cold. I want the Fan to come on when the proper temp is reached inside the casing and continue to operate until Furnace has cooled down to a certain point. Do you have any dual controls for this purpose of the type specified for Warm Air Furnace Installations. If so, what is the number of the control and the net price or list with present discount. Please send descriptive literature covering requirements and also advise if it is necessary to use two of these controls to accomplish desired results.

Thanking you for an early reply, I am.

Yours very truly,

A. D. Currens

PS My Fan is now hooked on separate Circuit from Oil Burner and would as soon operate it separately from Burner Circuit

10/23

Sept. 14, 1928.

The XXth Century Heating & Ventilating Co.,
Mr. A. . Currens, Representative,
124 The Drive,
Topeka, Kansas.

Dear Sir:-

MERCOID CONTROLS:

Your favor of September 10th has been noted and in response we wish to state that we could furnish our Fig. 80 Control, with standard range 200 to 300°F., mounted in the drum of the furnace and connected in the line ahead of all other controls. Please note our catalog.

Regarding the furnace fan, the same type of control is used, but with a range 190 to 140°, to cut in at high and off at low. The fan will not start until the dome reaches a temperature of 190° and will continue to run after the burner is off until the temperature in the dome drops to 140°, thus using the latent heat of the furnace. This latter control would be connected in series with the line and fan motors.

Both these controls list at $27.00 and we quote you a discount of 40%.

We refer you to page 33 of the enclosed catalog.

We are glad to have you consult us freely and we trust the above will give you the desired information.

Yours very truly,

THE MERCOID CORPORATION

SALES ENGINEER

H:H:L
Enc.

HOLLAND FURNACE COMPANY

ORLD'S LARGEST INSTALLERS OF FURNACES

Our Product

The Heart of the Home

HOLLAND
MICHIGAN

Beloit Wis.
Jan.11th.1929.

The Mercoid Corporation
534 West Adams St.
Chicago Ill.
Gentlemen :

We have a # 50 Holland installed which is using a Williams Oil-O-Matic Burner and is equipped with your Mercoid Thermostat.

We want to install our Aire-U-Well fan in this furnace to distribute heat to the long pipes ; and want a switch to start the fan after the temperature in the casing or hood has reached a high point , and to continue to run untill the burner has shut off and all the heat made is delivered to the rooms.

This fan operates on 110 Volts A.C. Current and we want to know if it can operate from the same circuit as the Thermostat or must be entirely separate.

Will your Furnacestat or limit control operate the fan as we wish ?

We will be pleased to receive your Catalog and whatever information you can give us.

Yours truly

T. B. Moore

Holland Furnace Co.
Beloit Wis. Branch
410 Broad St.

dealers 40%

January 1 , 1929

Holland Furnace Company,
Beloit, Wisconsin.

MERCOID CONTROLS
Gentlemen:- Attention - Mr. T. B. Moore

We have your favor of January 11th, and are pleased to advise we are in a position to furnish for the installation mentioned, our Figure 5 Mercoid Warm Air Furnace Fan Control. This instrument is illustrated and described on page 25 of our heating control catalog, copy of which we are enclosing. Our standard range for this work is 190 to 140°, cutting in at the high point to start the fan motor and cutting out when the dome temperature drops to the low point.

This control should be wired independent of the Thermostat circuit in order for it to operate satisfactorily.

The discount from list prices shown in our catalog is 40%, and in lots of 12 or more, 40-5%.

Thanking you for your inquiry, and hoping that we may have an opportunity of serving you, we remain

Yours very truly,

THE MERCOID CORPORATION

BF:DS
Encl.

B. F. Werb, Jr. - Sales Engr.

MERCOID EXHIBIT III

J. A. PORTNER

DISTRIBUTOR OF ELECTROL THE AUTOMATIC OIL BURNER

ELECTRICAL CONTRACTING
MOTORS AND SUPPLIES
ELECTRICAL REFRIGERATION
OIL BURNING EQUIPMENT FOR ALL PURPOSES
WATER SUPPLY EQUIPMENT
WATER SOFTENERS AND HEATERS
GARBAGE INCINERATORS

WHEATON, ILLINOIS

Nov 22-29.

Mercoid Corp.,
Chicago, ILL.
L.H.VanNess.

Dear Van:

Inclosed you will find proposed control scheme for the heating plant in my new show room, office and shop building now under construction. Can you furnish the thermostat in two circuit?

The building will be 24 ft front by 132 ft deep, front [illegible] ft show room, then 20 ft for offices and toilets, then 46 ft shop and rear 26 ft garage and storage.

I will use a Leader Cool-Stack Boiler and two 100,000 BTU unit heaters, one for the shop and the other for the show room and offices. The scheme shown will give me absolutely independant control of the two conditions and fully automatic. The 32 shown is for year round hot service indirectly through an Excelso heater.

Check this over and let me have your suggestions and dont forget that when and old cash customer is buying for his own use that it is customary to get a better price.

Thanking you for any suggestions, I am

Yours Resp't.

J. Portner

VN-JP

[illegible] can furnish 2 circuit Thermostat [illegible] suggest Fig 71 to replace 612 set at 0-2# pressure [illegible] contacts direct to [illegible] of water and will take care of [illegible] as per Mr [illegible] instructions

[illegible]

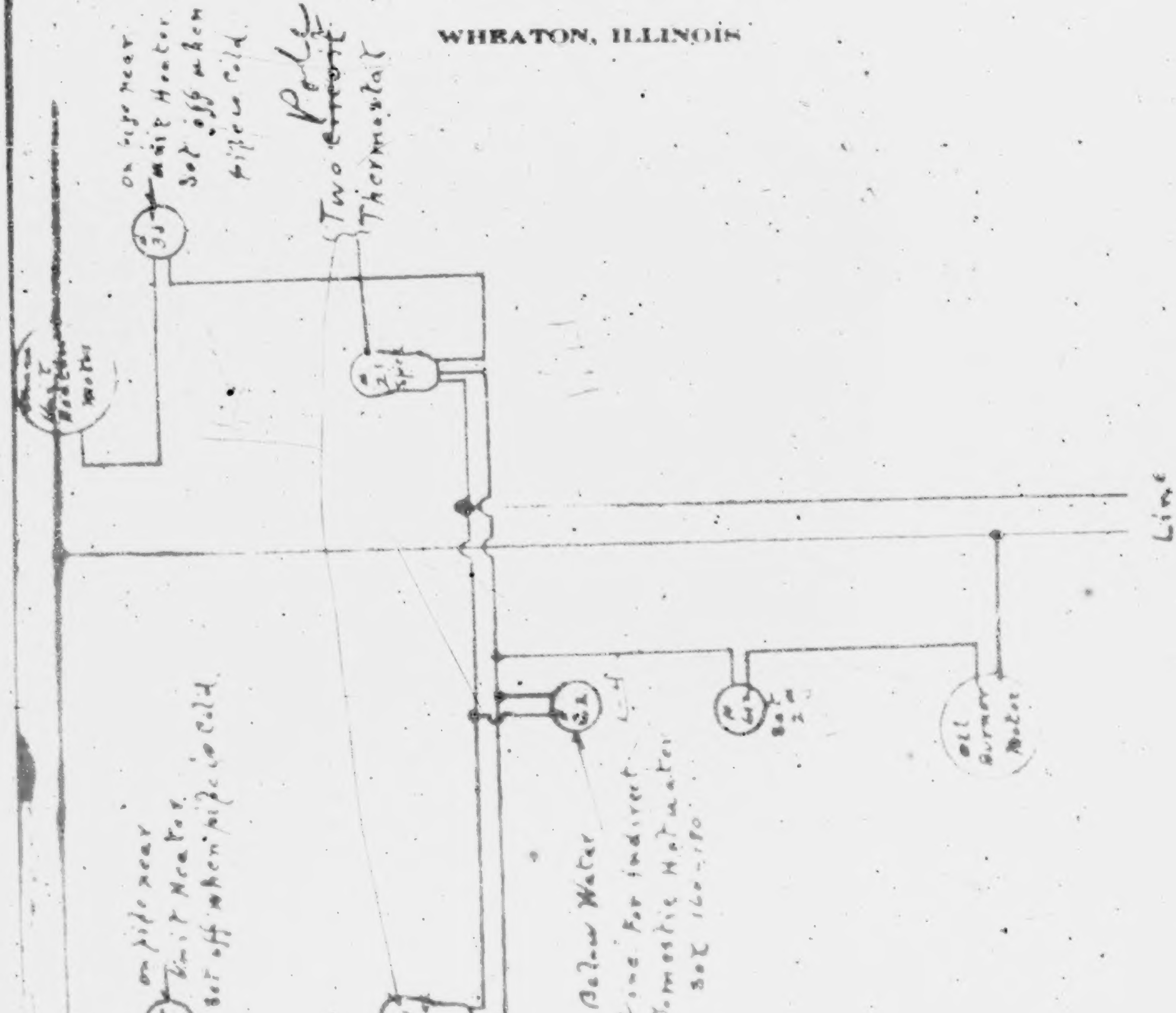
J. A. PORTNER

SALES, SERVICE AND ACCOUNTING DEPTS.
N. WHEATON AVE.
PHONE WHEATON 208

DISTRIBUTOR OF
ELECTROL
THE AUTOMATIC OIL BURNER

ELECTRICAL CONTRACTING
MOTORS AND SUPPLIES
ELECTRICAL REFRIGERATION
OIL BURNING EQUIPMENT FOR ALL PURPOSES
WATER SUPPLY EQUIPMENT
WATER SOFTENERS AND HEATERS
GARBAGE INCINERATORS

WHEATON, ILLINOIS



THE MERCOID CORPORATION

554 WEST ADAMS STREET
CHICAGO

INVOICE NO

CHARGE TO J A PORTNER
901 N WHEATON AVE
WHEATON
ILL

ORDER NO 7949
CUST NO HAV
ENTERED 1-3-29

DATE OF INV JAN
DATE SHIPPED
TERMS

THIS INVOICE IS PAYABLE AT PAR IN NEW YORK OR CHICAGO FUNDS

SHIPPED TO ABOVE

SHIPPED FROM CHICAGO VIA EXPRESS

QUANTITY				AMOUNT	EXTENSION	TOTAL
1		MERCOID FIG 71 COMB SINGLE POLE SINGLE CIRCUIT 1 TO 4# PRESS CONTROL AND LOW WATER CUTOFF				
3		MERCOID FIG 35 SINGLE POLE SINGLE CIRCUIT ~~140~~ 116 TO200 DEGREE RISERTHERM				
2		MERCOID 845-237 FIG 21 DOUBLE POLE SINGLE CIRCUIT 56 80 DEGREE HTG THERMO				
1		ADJUSTABLE CONNECTION BAR 2 1/4 INCH LENGTH FOR FULL AUTOMATIC OPERATION				
1		DITTO 2½ INCH LONG	NET LOT		42 00	42 00
						3
			T [illegible] TAX [illegible]			
						37.67

MERCOID EXHIBIT KKK-1

J. A. PORTNER
~~225 W. FRONT ST.~~
WHEATON, ILLINOIS

Copeland
DEPENDABLE Refrigeration
For those who want the finest

Dear Friend:

This is an announcement of the opening of our new show room and shop, at 225 W. Front St. This is more significant than just the opening of another store in town.

Our new building is 24 x 132 ft. and is the best equipped building for its purpose in DuPage Co., if not in the State of Illinois. This was made possible by the public's acceptance of two home comforts that were practically unheard of eight years ago, namely Domestic Electrical refrigeration and full automatic oil heating. Both have grown to be major industries in these brief few years.

Other than the two services mentioned we will display water softeners, pumps, water heaters, garbage incinerators, ventilating fans, oil burning boilers, and many other home comforts and labor-saving devices.

We have been in business in Wheaton for nineteen years and have demonstrated to our satisfaction that good merchandise, prompt and intelligent service and good wil[illegible] the necessary elements to attract and hold the pub[illegible]ic's [illegible]fidence.

We thank our many friends for their patronage and especially invite them to call and inspect our new store.

Yours very truly,

J A Portner

MERCOID EXHIBIT 111.

March 5, 1929.
(Dict. 3-4-29)

Mr. J. . Fortner,
2.5 . Front St.,
eaton, Ill.

Dear Jack:

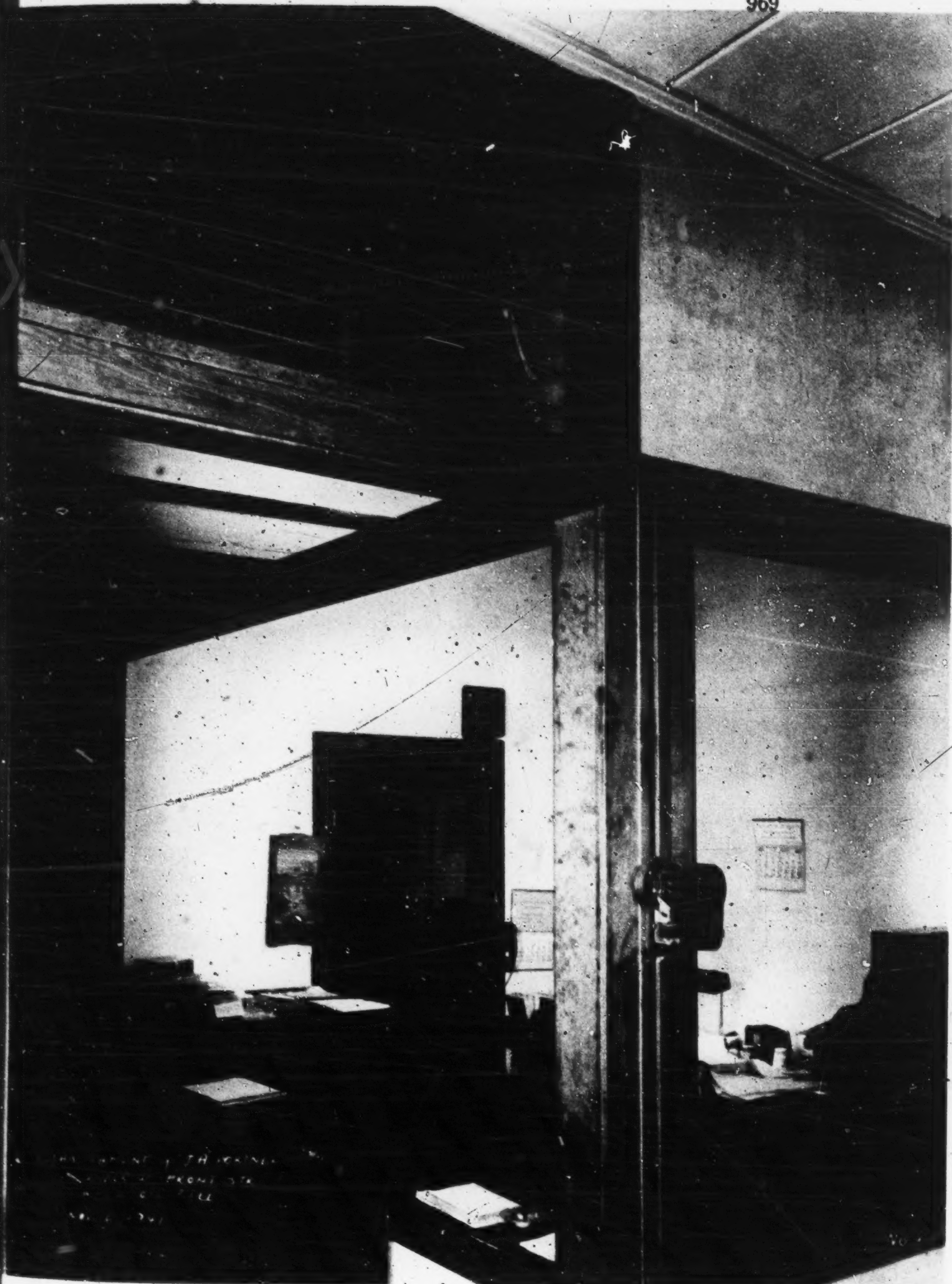
Congratulations, please, upon your announcement which came in this morning. It is certainly gotten up well, and I hope the Copeland people paid for it, as I observe no reference to oil burners.

You are certainly doing a worth-while job, and I am all for you.

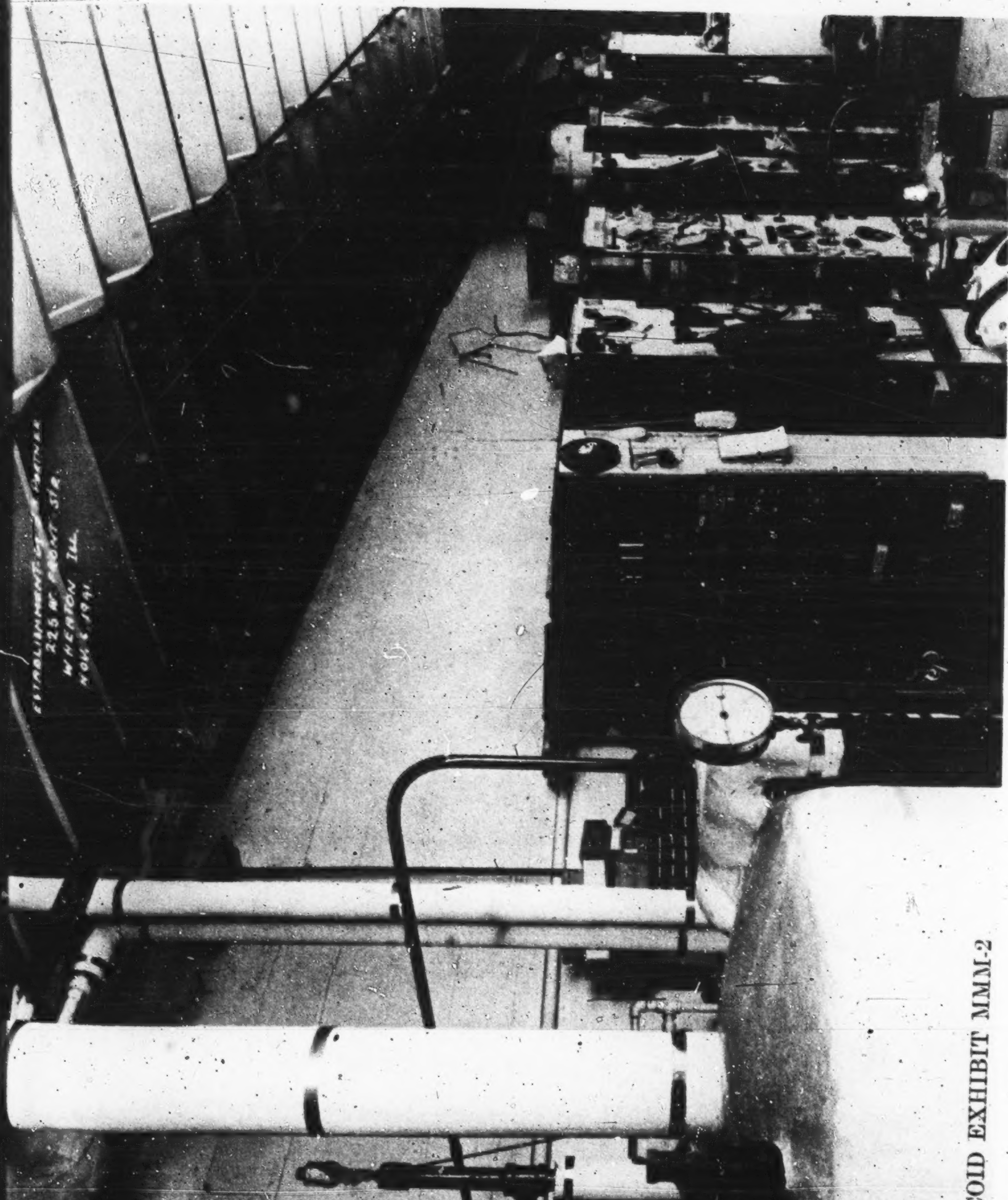
Best wishes, always.

LHVN:MVC

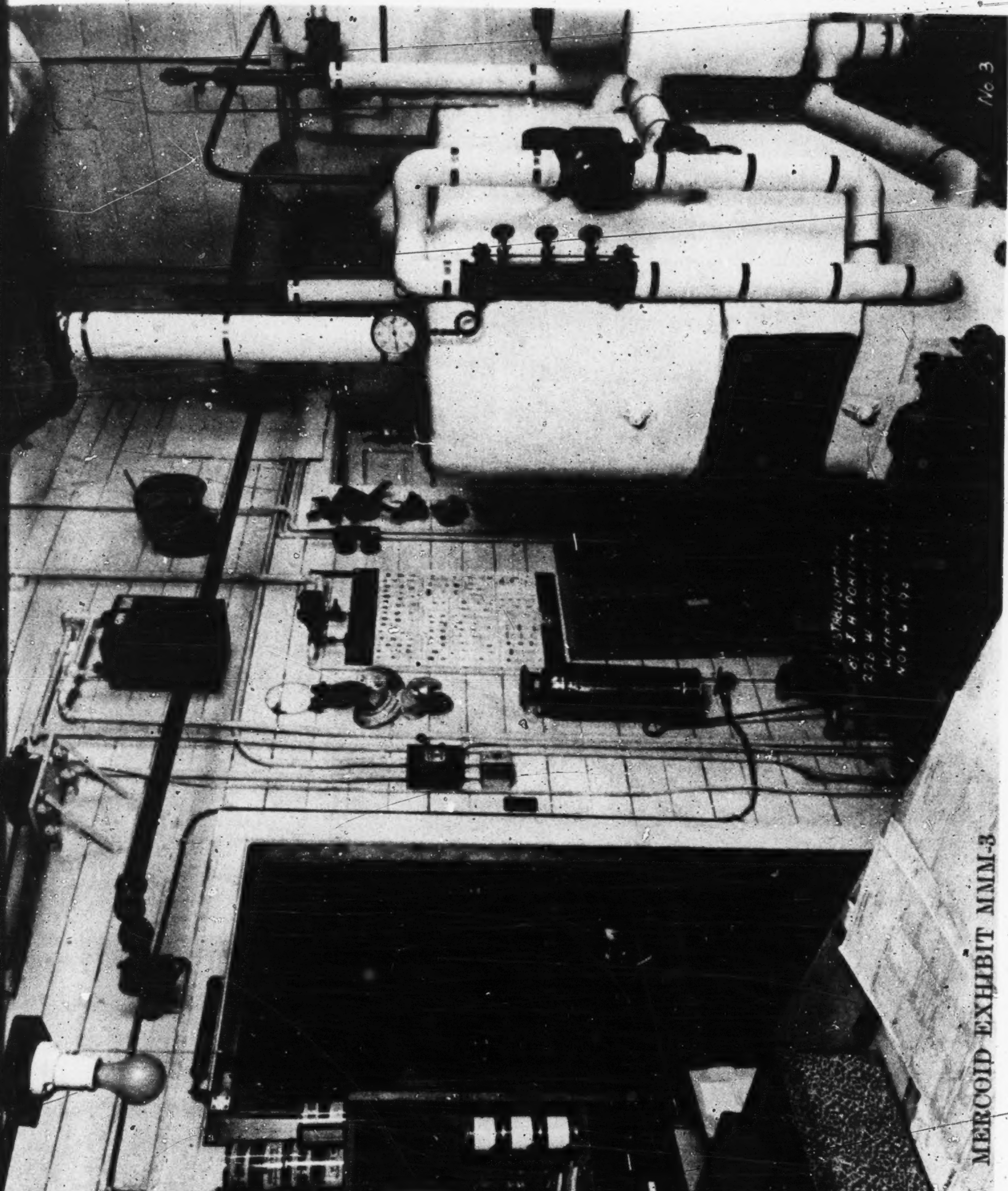
Sincerely,



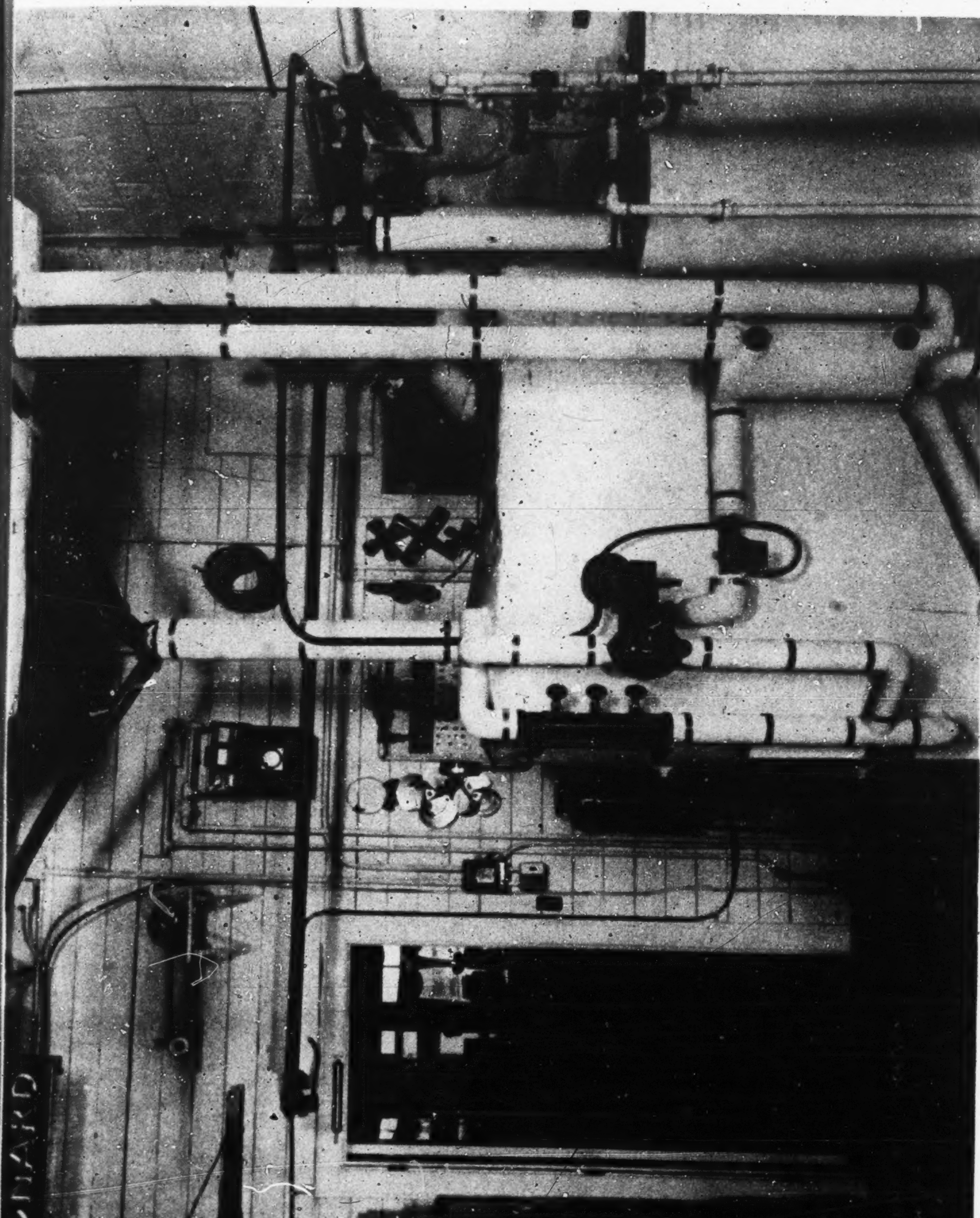
MERCOID EXHIBIT MMM-1



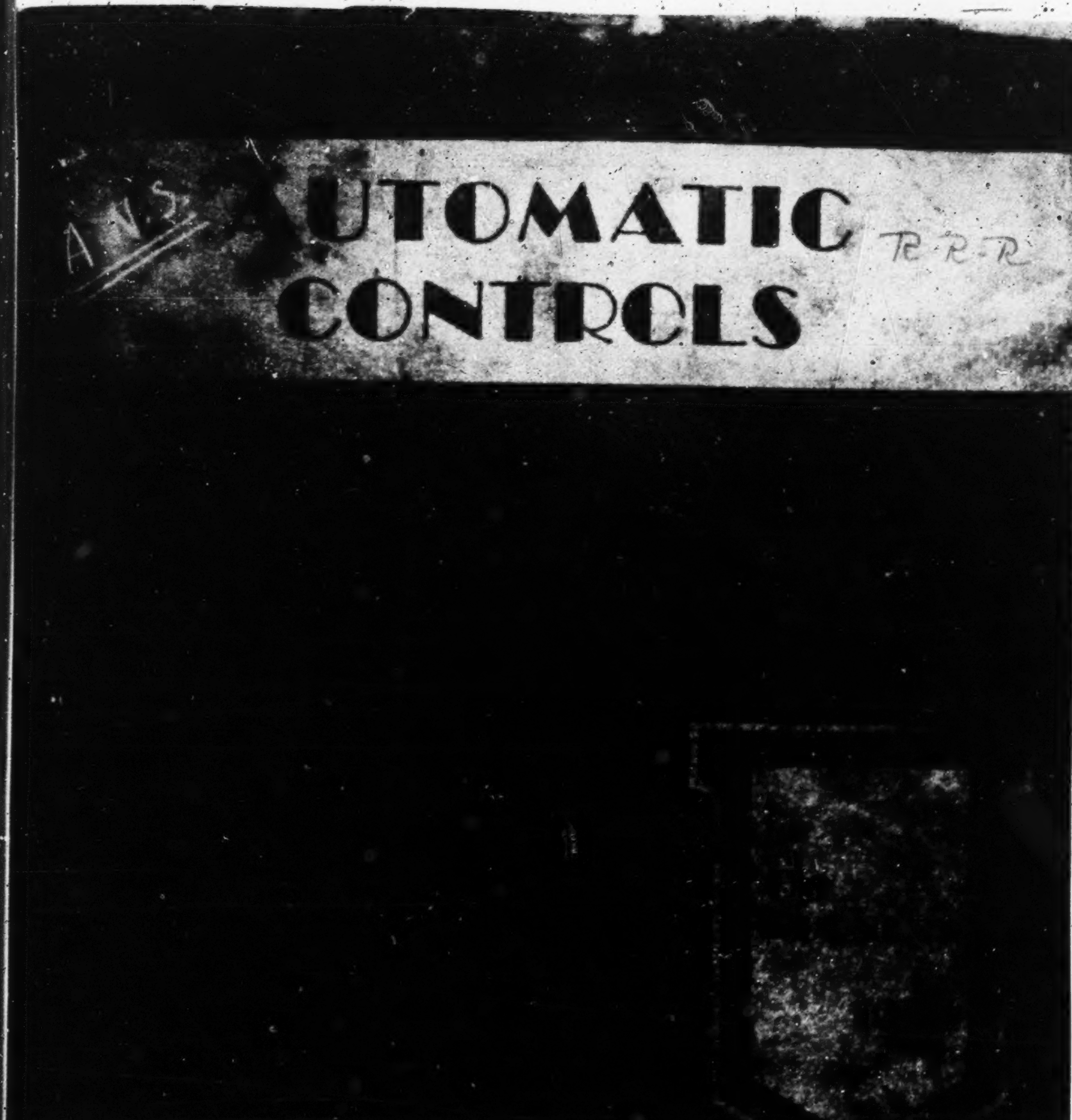
MERCOID EXHIBIT MMM-2



MERCOID EXHIBIT MMM-3



MERCOID EXHIBIT MMM-4



MERCOID EXHIBIT RRR

AUTOMATIC CONTROLS FOR OIL BURNERS

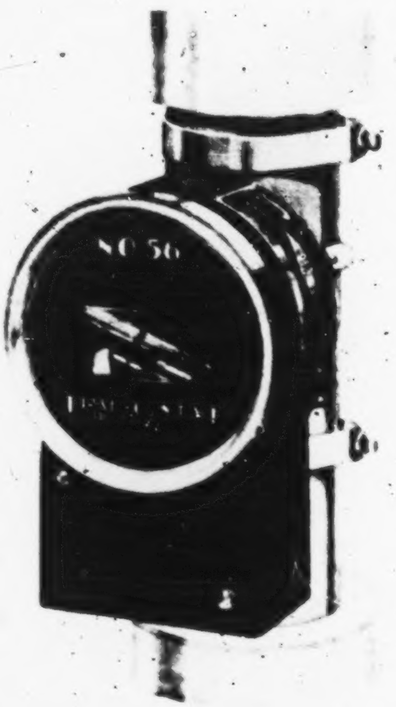
TIME-O-STAT
AUTOMATIC
CONTROLS

Also Manufacturers of Automatic Controls for Gas Burners, Coal Burners, Electric Refrigerators, Mechanical Stokers, Furnace Fans, Industrial Ovens, Ice Machines, Unit Heaters, Water Heaters. Also Sign Flashers, Mercury Switches, Electric Heaters, Corrugated Metal Bellows

TIME-O-STAT CONTROLS COMPANY
ELKHART, INDIANA

Surface Type Limit Control

For Hot Water Systems



The No. 56 Aquaswitch

Function

THE Aquaswitch offers accurate and dependable control of oil burner hot water systems, and, in addition, it is extremely simple to install.

This control is designed to be clamped to the hot water riser near the boiler and receives its temperature changes by conduction through its back which is in contact with the hot pipe. There is no necessity for tapping or draining the system if the Aquaswitch is used. It can be used either in a horizontal position as shown in the sketch at the bottom of the next page or in a vertical position as indicated in the illustration above.

Dual Application

Like the other Time-O-Stat Limit Controls, the No. 56 and No. 56B Aquaswitch can be used as the operating control of the burner or as a dual control in conjunction with a room thermostat. When adjusted to maintain water temperatures which will provide a satisfactory temperature in the room, the full operation of the burner may be accomplished with the Aquaswitch. Where the temperature control is desired from a room thermostat, the temperature setting on the Aquaswitch is advanced and it then acts as a safety cut-out should the room thermostat fail to cut off the burner before an excessive water temperature is reached.

Use on Domestic Hot Water Tanks

With the Aquaswitch suitably mounted on a summer hot water storage tank it is an excellent control for maintaining water at an even temperature irrespective of thermostat operation. If the water is heated by a separate burner, the Aquaswitch may be used as a direct control for the burner. When one burner provides heat for both the house and the water in the storage tank, a Room Thermostat and Aquaswitch can be arranged to properly control the burner.

Line and Low Voltage Models

The No. 56 Aquaswitch is a two wire control and operates at line voltage. The No. 56B is a three wire control and therefore can be used successfully on three wire low voltage systems.

For those installations where the burner motor has an electrical capacity in excess of the No. 56 Aquaswitch, Time-O-Stat offers the No. 56D. This control incorporates a Con-Tac-Tor Hywatt Mercury Switch capable of handling burner motors up to one H. P. single phase. In all other respects the No. 56D is identical with other Aquaswitch models.

How it Operates

The Aquaswitch receives the various temperature changes by conduction through the back of the instrument which is in contact

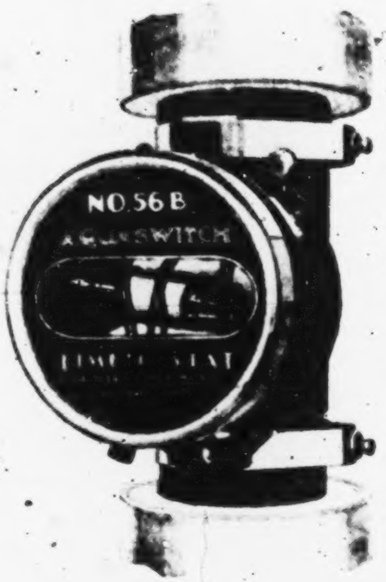
TIME-O-STAT CONTROLS COMPANY

ELKHART, INDIANA

Surface Type Limit Control

For Hot Water Systems

with the hot pipe. In the case of this control is a spiral of bimetal on the central axis on which a Mercury Switch is mounted. On a change in temperature the spiral expands or contracts, causing the rotation of the axis. Simultaneously the Mercury Switch tilts to "on" or "off", making or breaking the circuit with burner.



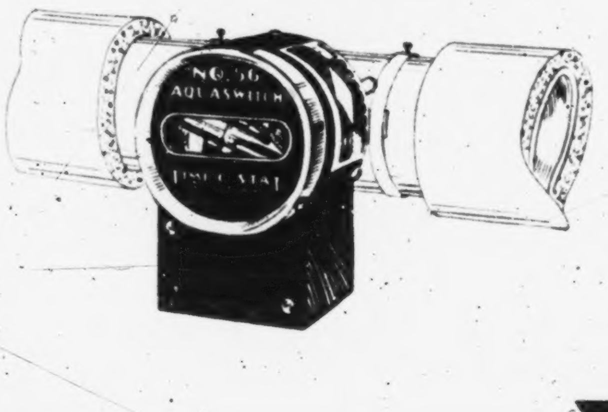
The No. 56B Aquaswitch

Construction Features

As mentioned above, the construction of the Aquaswitch is such that it insures the utmost ease of installation, through the elimination of the necessity of tapping or draining the system. In addition it can be used either in horizontal or vertical position, being equipped with two pairs of mounting ears. Whichever pair is not utilized may be removed.

This control can be adjusted for a temperature range of from 100° to 200° F. and the differential between the cut-in and cut-out temperature is 10° F. There is an external adjustment lever and graduated scale for the setting of the temperature range. This control, equipped with a Mercury Switch whose contacts cannot be affected by dust, moisture or corrosion, will give long and satisfactory service.

Horizontal Installation



SPECIFICATIONS

No. 56 (2 wire): For line voltage circuits.
- Resistance Loads: 10 A. 110 V.; 5 A. 220 V.
- Motor Loads: ½ H. P. 100-250 V. A.C.; ¼ H. P. 100-250 V. D.C.
- On D.C. or 25 Cycle parallel Mercury Switch with M377 Condenser. See page on Condenser at back of catalog.

No. 56B (3 wire): 4 A. 25 V. For low voltage circuits.

No. 56D (2 wire): For line voltage circuits.
- Resistance Loads: 15 A. 110 V.; 10 A. 220 V.
- Motor Loads: 1 H. P. 100-250 V. A.C.; ½ H. P. 100-250 V. D.C.
- Adjustable Range: 100° to 200° F.
- Differential (Not Adjustable): 10° F.
- Shipping Weight: 4 lbs.
- Height: 5½". Width: 4½". Depth: 2½".

List Price, No. 56 or 56B **$17.50**

List Price, No. 56D **$20.00**

INSTALLATION INSTRUCTIONS

IMPORTANT: Do not attempt any adjustments until these instructions are thoroughly understood.

TYPES M-80, M-82, M-84 WARM AIR COMBINATION FAN and LIMIT CONTROLS

Patent Numbers 1,398,874, 1,640,869 1,705,909, 1,757,436, 1,834,288, 1,884,046, 2,018,310. Others Pending

EXHIBIT No. 1-A
DATE 9-2- 1940
NOTARY PUBLIC, COOK CO., ILLINOIS COMMISSIONER

CAUTIONS

1. Mercoid Combination Furnace Controls leave the factory with the bi-metallic element properly formed, heat treated, stabilized and calibrated.

DO NOT TWIST BI-METAL COIL as twisting or bending may permanently distort it. Not only will this destroy the correct calibration of the instrument but also the accurate performance after adjustment is made. In case of a badly distorted bi-metallic element, send control to factory for recalibration, or a new bi-metallic element may be ordered for replacement. In ordering element, give serial number of instrument.

Should the temperature reading be in error due to a twisted bi-metallic element, if not excessively twisted it may be readjusted by allowing the instrument to reach room temperature, loosening the nut in the center of the dial and moving dial until correct reading is obtained, then tighten nut.

2. DO NOT OVERLOAD—Check name-plate which shows the electrical capacity in amperes, and make certain that the load is within this rating.

3. DO NOT OIL PARTS—All bearings are self lubricating. Oil accumulates dirt, becomes gummy with age and heat, and interferes with the operation of the control.

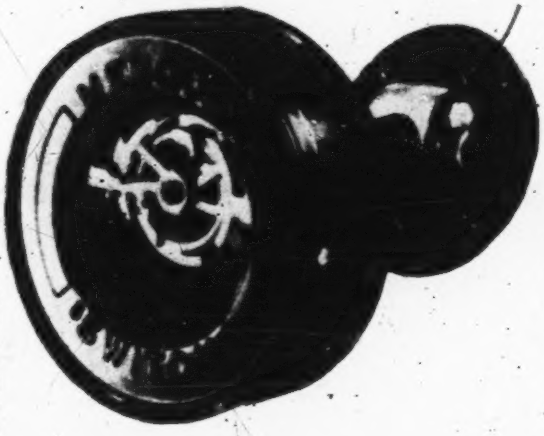
4. DO NOT OVERHEAT—Instrument must not be subjected to temperatures higher than maximum shown on nameplate or graduated scale.

TYPE M-80SW, M-82SW, M-84SW — WITH LOCK TYPE SUMMER SWITCH

These instruments are provided with a manual switch for operating the fan for ventilating purposes during "Summer" or periods when the furnace is not heated. By turning button on front of case to left or anti-clockwise the fan switch will lock in "On" position. This lock will automatically release and return instrument to normal "Winter" operation as soon as the furnace is again heated.

MOUNTING

Select proper location for both appearance and operation. Do not locate bi-metallic element less than three inches from the dome.



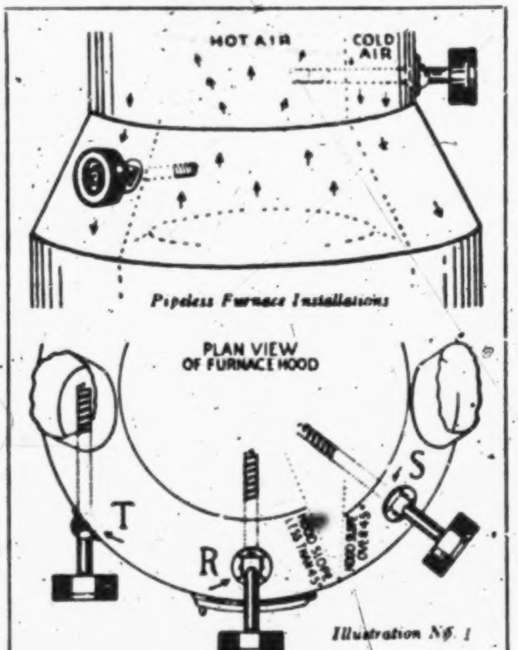


Illustration No. 1

Illustration No. 2
"K" Flange Bolt, "L" Instrument Stem, "N" Revolving Clamp, "O" Locking Nut, "P" Flange Bracket.

Control is usually placed on sloped hood. The adjustable flange permits mounting on any hood angle from 30 to 90 degrees, and the instrument will always be at a radius from the center of the dome. (See illustration 1 designated by "R" and "S".) If the furnace is so constructed that the control cannot be mounted on the sloped hood, or if there are internal obstructions such as fan blades, the control can be mounted on the straight side walls and positioned as shown in "T" illustration 1. The flange in this case is mounted so that it is adjustable horizontally, and the control can be positioned so that it faces directly to the front.

After location has been determined, cut a $2\frac{3}{8}$" or $2\frac{1}{2}$" hole with a rotary hack saw. Place adjustable flange against hole in correct position, and mark holes for screws. Punch a small hole at each screw position, and then fasten flange with the four sheet metal screws furnished.

If the control does not slide easily into the flange, loosen the locking nut "O" illustration 2 and position the flange bolt "K" so that its curved side is down. Do not force the control or the bi-metal coil may be distorted.

Before tightening the locking nut "O", illustration No. 2, see that the instrument is level and also vertically lined up. This may be determined by sighting across cover screws "C-C" (see illustration No. 3) and making certain that they are level or horizontal. It is also well to check back to see that both mercury tube switches "A" and "B" illustration No. 3, are in free operating order. This is done by first carefully opening up or separating the "high" and "low" adjustments on each side of the dial to their widest differential or as far as they will go as shown by arrows "D" in illustration No. 3. After this is done both the fan switch tube and limit switch tube should be free to tilt to either side.

Note carefully that when tilting each switch, first to one side and then to the other, that the tubes remain respectively to the sides that they are tilted. This will be an assurance that the control is in correct operating position.

(Continued on other side).

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INSTALLATION INSTRUCTIONS (cont'd)

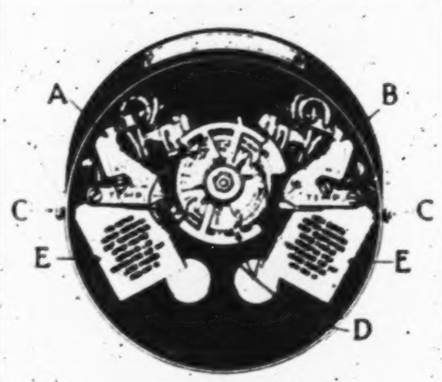


Illustration No. 3

Illustration No. 5

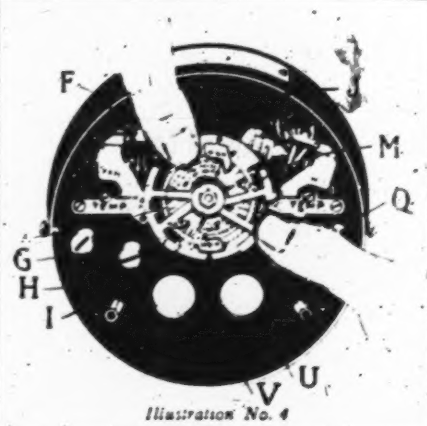


Illustration No. 4

WIRING

Take off both shield insulating plates "E" illustration No. 3, by removing the screws at the bottom of each plate. Terminals "G" and "H" at the left, are for Fan Switch connections and terminals "U" and "O" at the right are for Limit Switch connections.

When making connections, scrape and clean the wires and carefully place around the terminal screws and in the groove provided (see illustration No. 5). After wiring, fasten insulating plates back in position, seeing that the printed instructions are kept to the outside so that they may be read. Rigid conduit must not be attached directly to instrument case. Use short strips of BX to relieve control of conduit expansion and contraction strains.

ADJUSTMENT

The instrument can now be adjusted to the desired operating points.

The fan control is usually set about 120 degrees low to 150 degrees high. On the majority of warm air installations, using forced circulation, the limit switch is usually set to cut out at temperatures between 200 and 250 degrees. The cut-in point is usually set at approximately 50 degrees below the cut-out point. There are, however, many installations in which this particular adjustment might be insufficient or excessive, therefore a careful study of each case must be made.

When setting the cut-in and cut-out points, hold the ratchet wheel dial, snugly with your thumb or finger to keep it from moving while you press and shift the indicating "high" and "low" lever settings. Illustration No. 4 shows the thumb holding the wheel "F" while the other thumb is used in pressing back and moving the "low" limit lever setting "M." The reason for pressing the "high" and "low" settings (four in all) before attempting to shift to the desired setting is shown in illustration No. 6. Note in illustration No. 6, the picture to the right, as both high and low settings are being pressed, it disengages the prongs "W" and "X", out and away from the ratchet wheel, to permit moving the adjustment up or down. As soon as the pressure is released, the prongs spring back between the teeth of the ratchet, thereby securely fixing the setting. Care should be taken after each setting is made, to see that the prongs are engaged between the ratchet teeth as shown in the left illustration indicated as "Y" on the high and "Z" on the low setting.

The illustration above shows dial with range used on Type M-82.

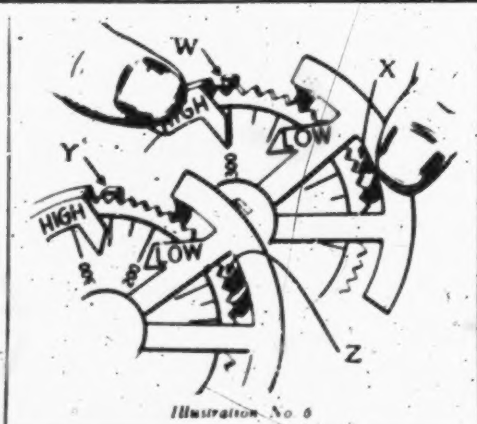
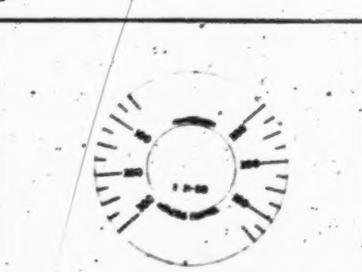


Illustration No. 6



The illustration above shows dial with range used on Type M-80.

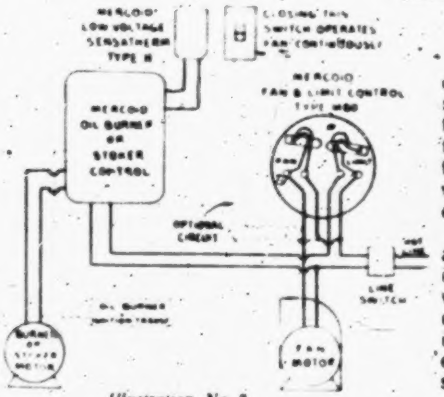


Illustration No. 7

Fan hook-up in connection with oil or stoker fired warm air furnace. Closing optional circuit operates fan continuously for ventilating purposes during summer.

With this hook-up, after the thermostat is satisfied, the fan will continue to run until the temperature in the furnace bonnet drops to the control setting.

Stokatherm or Stok-A-Timer control of single phase stoker and circulating fan motors on warm air system. When Sensatherm calls for heat stoker starts but fan can start only after furnace is heated. When room is at required temperature, Sensatherm circuit opens which immediately stops both fan and stoker motor.

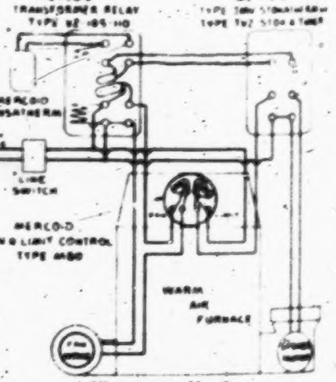


Illustration No. 8

INSTALLATION INSTRUCTIONS

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MERCOID WARM AIR FURNACE CONTROLS

TYPES M-51, M-52, M-53, M-53 SW, M-55, M-56, M-57, M-57 SW

Patent Numbers 1,598,874, 1,640,869, 1,705,989, 1,752,957, 1,757,436, 1,834,288, 1,884,046. Others Pending

CAUTIONS

1. Mercoid Furnace Controls leave the factory with the bi-metallic element properly formed, heat treated, stabilized and calibrated.

DO NOT TWIST THE BI-METAL COIL as any manual twisting or bending may permanently distort it. Not only will this destroy the correct calibration of the instrument but also the accurate performance after adjustment is made. It is recommended in case of a badly distorted bi-metallic element, that the instrument be either sent back to the factory for recalibration or a new bi-metallic element ordered for replacement. In ordering element for replacement the serial number of the instrument should be supplied.

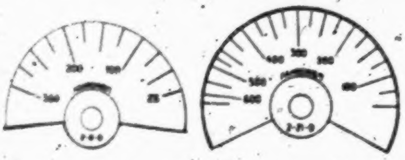
Should the temperature reading be in error due to an accidentally twisted bi-metallic element, if not excessively twisted it may be readjusted by allowing the instrument to reach room temperature, loosening the nut in the center of the dial and moving dial until correct reading is obtained, after which the nut should be tightened.

2. DO NOT OVERLOAD—Check the instrument nameplate which shows the electrical capacity in amperes, and make certain that the load to be handled is within this rating.

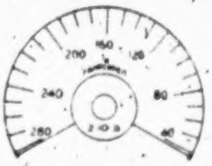
3. DO NOT OIL ANY PARTS—All bearings are self lubricating. Oil accumulates dirt, becomes gummy with age and heat, and interferes with the free operation of the control mechanism.

4. DO NOT OVERHEAT—At no time should the instrument be subjected to a temperature higher than the maximum shown on the nameplate or graduated scale.

STANDARD DIALS USED ON MERCOID FURNACE CONTROLS



Standard dials for types M-51, M-52, M-53 and M-53SW



Standard for type M-55, M-56, M-57 and M-57SW

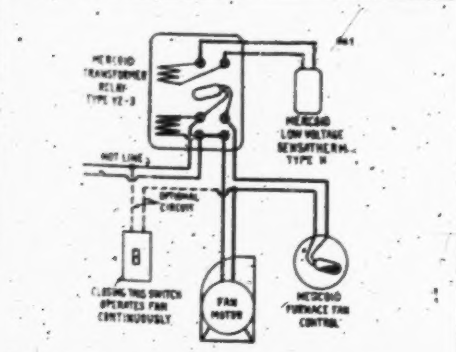
Type M-51, M-52, M-53 and M-53SW are available with two different bimetal coils for different temperature ranges. The operation of these instruments is in accordance with the graduations on the dials as shown.

Type M-55, M-56, M-57 and M-57SW dial is graduated evenly and gives extremely close regulation at any point on its range. This type instrument should be employed in place of Type M-51, M-52, M-53 or M-53SW when very close operating differentials are desired, and the operating temperature is within the range of this instrument.

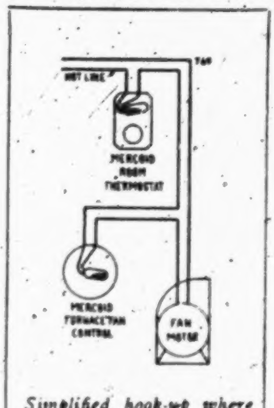
TYPE M-53 SW and M-57 SW — WITH LOCK TYPE SUMMER SWITCH

Types M-53SW and M-57SW normally prevent operation of the fan unless the furnace is heated. To operate the fan for ventilating purposes during "Summer" or periods when the furnace is not heated, turn button on back of the case to the right or clockwise. The switch will lock in the "On" position and permit operation of the blower as desired, but will automatically release and return to normal "Winter" operation as soon as the furnace is again heated.

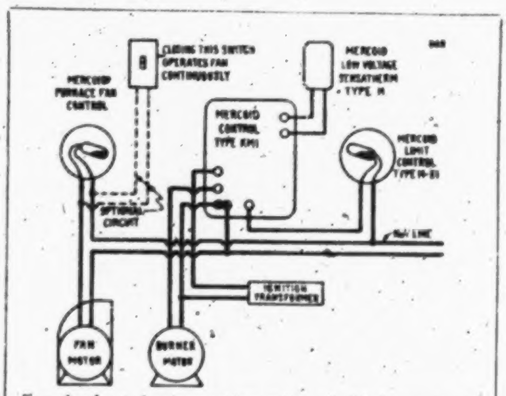
GENERAL WIRING DIAGRAMS



General hook-up showing optional fan switch circuit. By closing this circuit fan can be operated for ventilating purposes during summer. No changes of control setting are required.



Simplified hook-up where high voltage thermostat is employed.



Fan hook-up in connection with oil fired warm air furnace. Closing optional circuit operates fan continuously for ventilating purposes during summer.

(Continued on other side)

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INSTALLATION INSTRUCTIONS (cont'd)

MOUNTING

Care should be used in selecting a proper location for both appearance and operation. Do not locate bimetallic element less than three inches from the dome.

The instrument is usually placed on the sloped hood of the furnace. The adjustable flange permits mounting on any hood angle from 30 to 90 degrees, and the instrument will always be at a radius from the center of the dome. (See illustrations 3 and 4 designated by "R" and "S.") If the furnace is so constructed that the control cannot be mounted on the sloped hood, or if there are internal obstructions such as fan blades, the control can be mounted on the straight side walls and positioned as shown in "T" illustration 4. The flange in this case is mounted so that it is adjustable horizontally, and the control can be positioned so that it faces directly to the front.

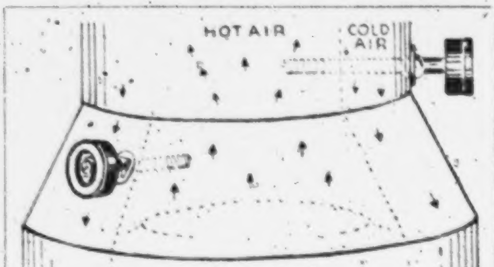


Illustration 3
Pipeless Furnace Installations

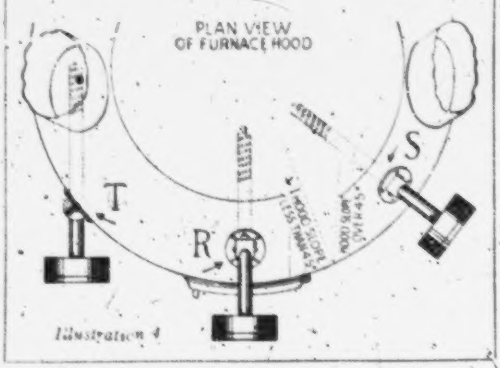


Illustration 4

After the proper location has been determined, cut a 2⅜" or 2½" hole by means of a rotary hack saw. Place the adjustable flange against the hole and in the correct position, and mark the holes for the screws. Punch a small hole at each screw position, and then fasten the flange by means of the four sheet metal screws furnished.

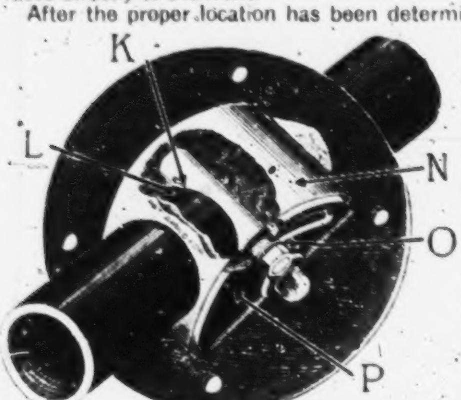


Illustration 5
"K" Flange Bolt, "L" Instrument Stem, "N" Revolving Clamp, "O" Locking Nut, "P" Flange Bracket.

If the control does not slide easily into the flange, loosen the locking nut "O" illustration 5 and position the flange bolt "K" so that its curved side is down. Do not force the control or the bimetal coil may be distorted.

Before tightening the locking nut "O", see that the instrument is level and also lined up vertically. This may be determined by separating the "high" and "low" adjustable pointers, "C" and "D", illustration 6, far enough apart so that they hold the switch kicking plates away from the switch tripping arm "E." The switch must move freely

Illustration 6

from left to right without interference of the kicking plates. If the switch remains to either the right or left after tilting with the finger, the instrument is ready to be fastened by tightening lock nut on flange.

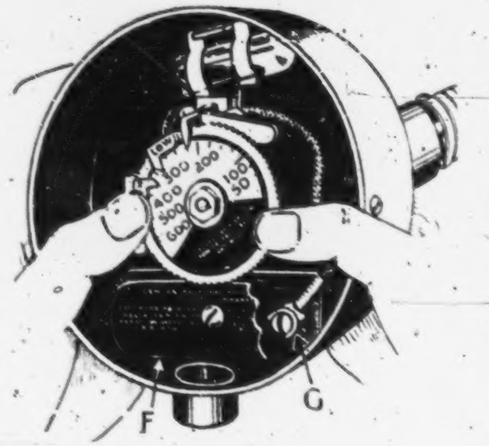


Illustration 7

WIRING

Illustration 8

Remove insulating plate indicated as "F" in illustration 7, by removing screw located in center of plate. Scrape and clean the wires and carefully place around the terminal screws and in the groove provided (see illustration 8). After wiring, fasten insulating plate back in position.

ADJUSTMENT

The instrument can now be adjusted to the desired operating point.

For fan control the usual setting is about 120 degrees low to 150 degrees high. In case the M-51 is used as a limiting device, the majority of warm air installations are set at approximately 250 to 300 degrees. There are, however, many installations in which this particular adjustment might be insufficient or excessive, therefore a careful study of each case must be made. BEAR IN MIND THAT THE SAME RESULTS OF OPERATION CAN BE OBTAINED BY LOCATING THE BIMETALLIC ELEMENT FARTHER AWAY FROM THE DOME AND ADJUSTING TO OPERATE AT A LOWER RANGE. When setting the cut-in and cut-out points, hold the ratchet wheel firmly with one hand while pressing and moving either the high or low pointer; see illustration 7. When pressing pointers see that the catch between the teeth of the ratchet wheel is disengaged, as shown in "I" illustration 9. When releasing the pressure, be certain that the catch is again engaged, as shown in "J."

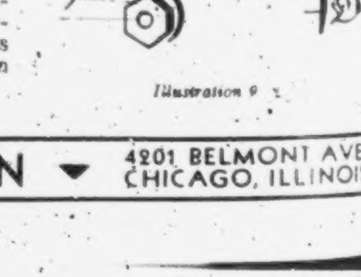
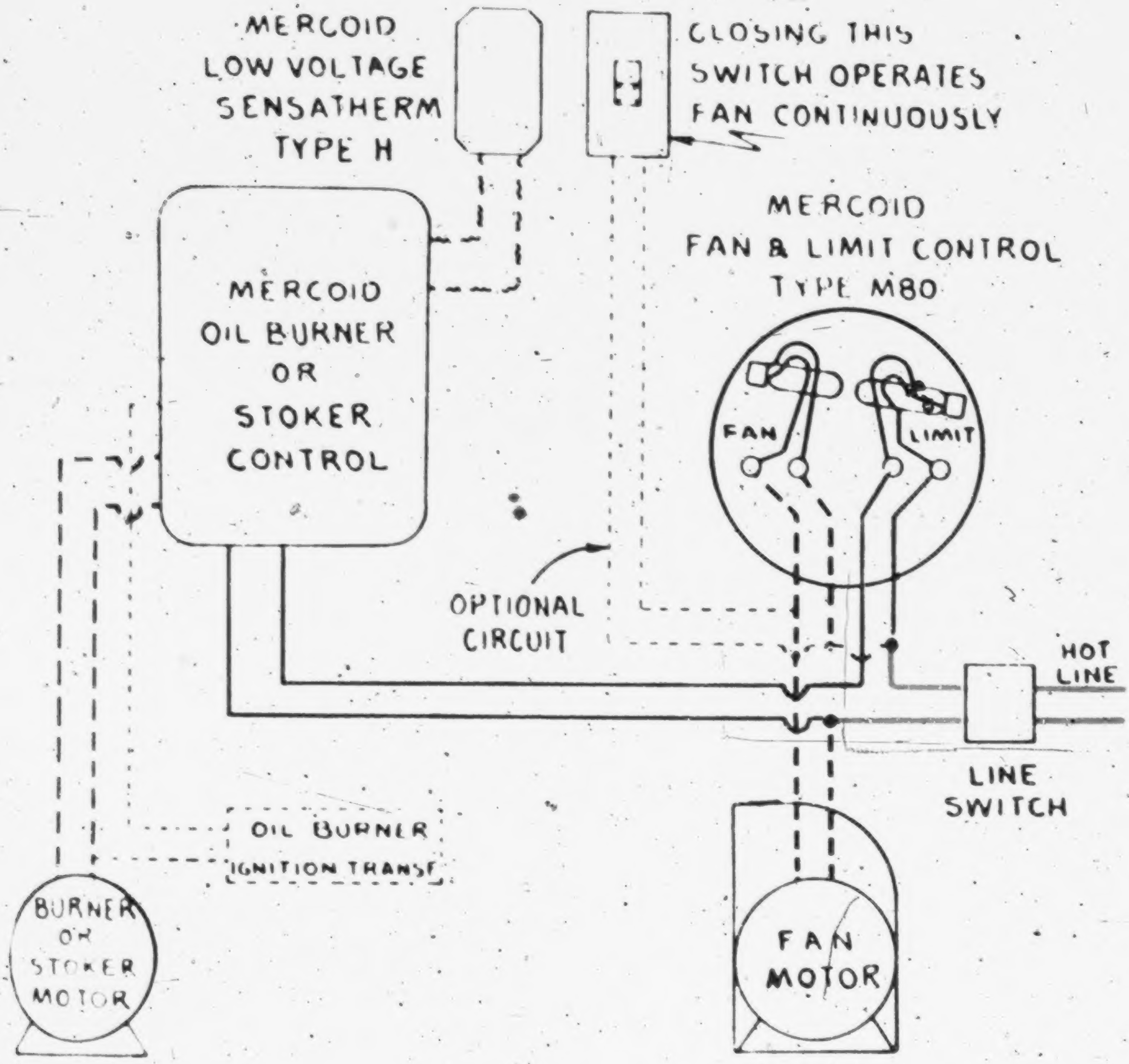


Illustration 9



POSITION 1: ROOM WARM - FURNACE COLD

Room thermostat off

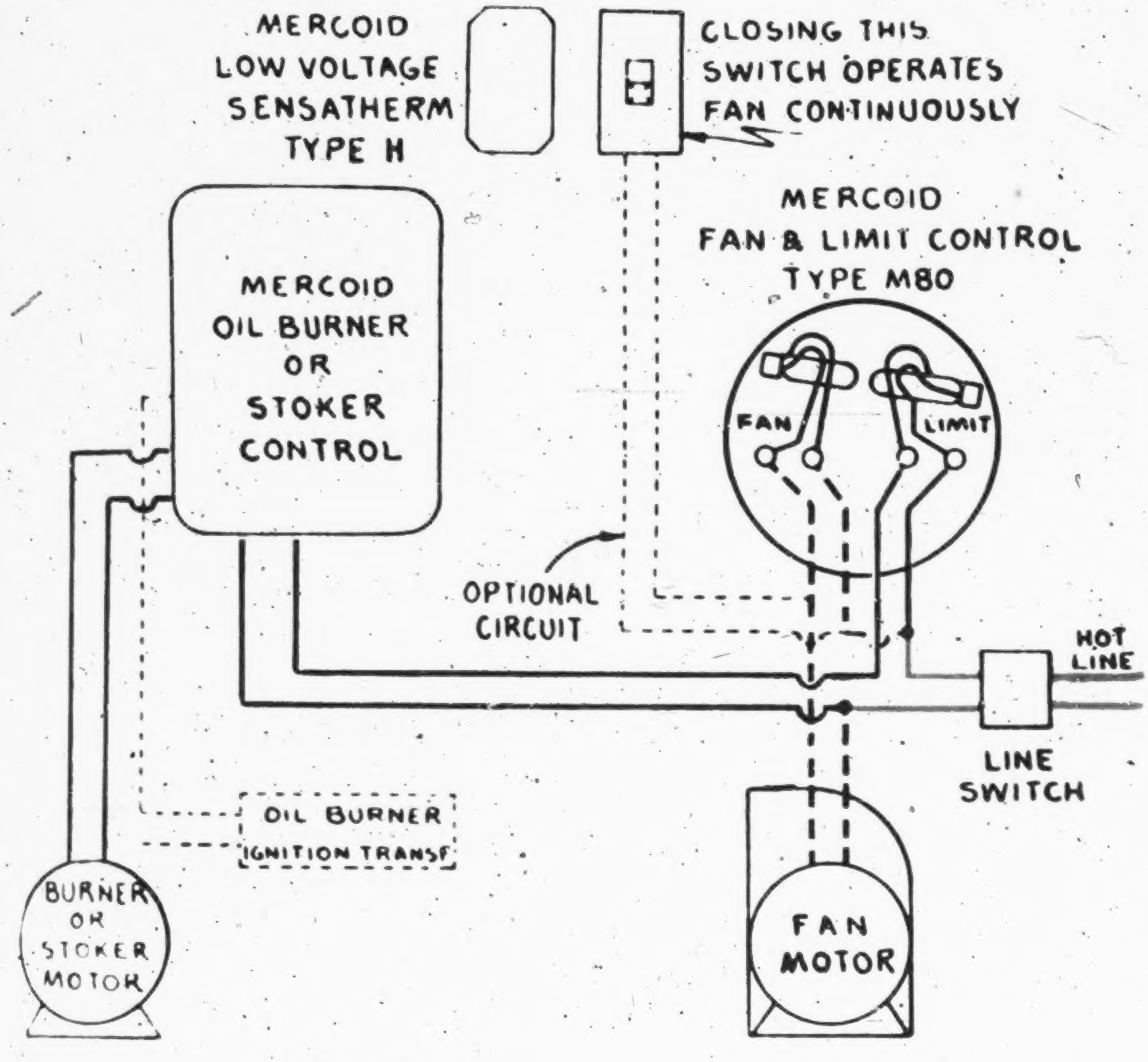
Limit switch closed

Fan switch open

Burner off

Fan off

M-H EXHIBIT 2a



POSITION 2: ROOM COLD - FURNACE COLD

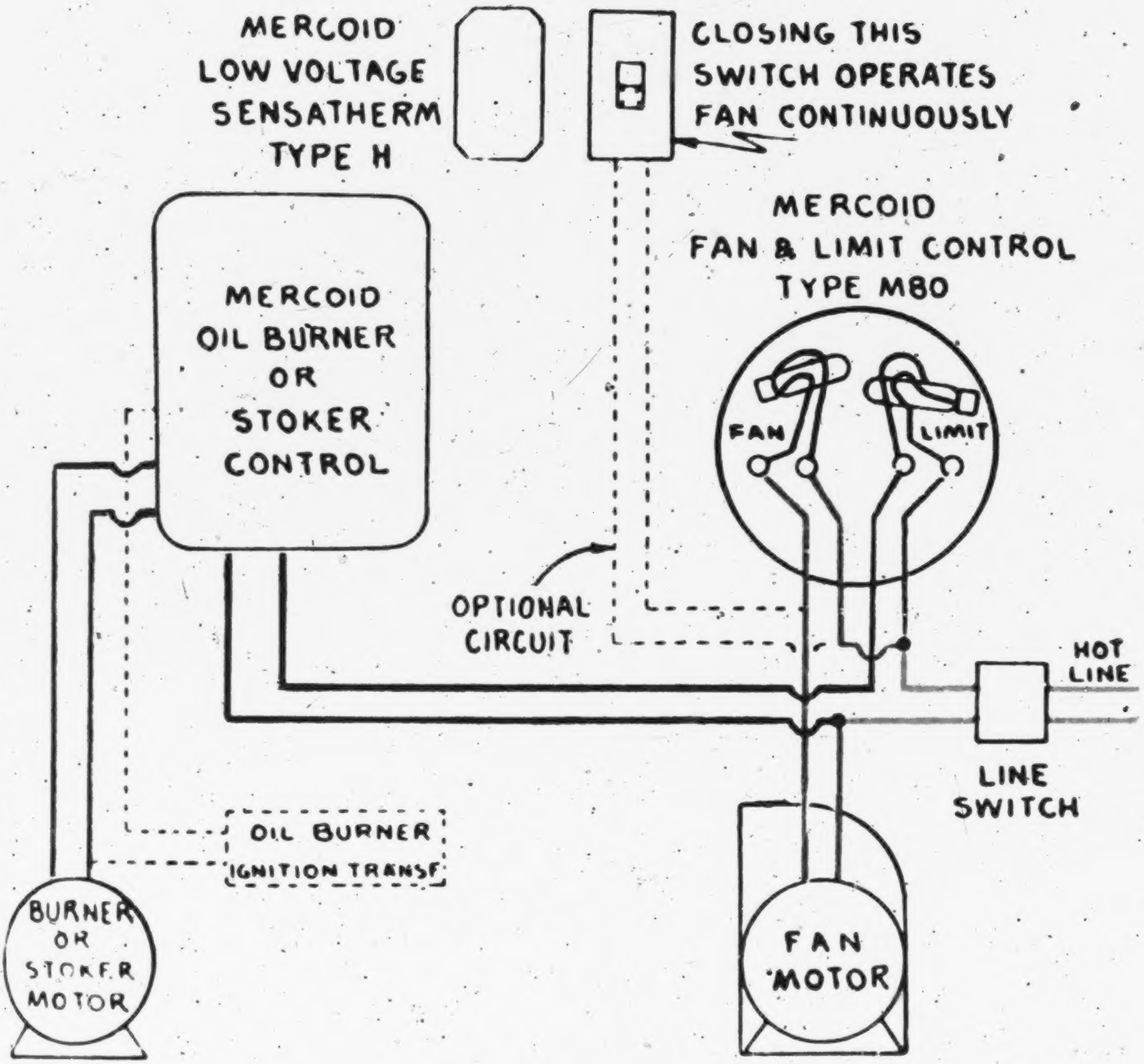
Room thermostat on

Limit switch closed

Fan switch open

Burner on

Fan off



POSITION 3: ROOM COLD - FURNACE WARM

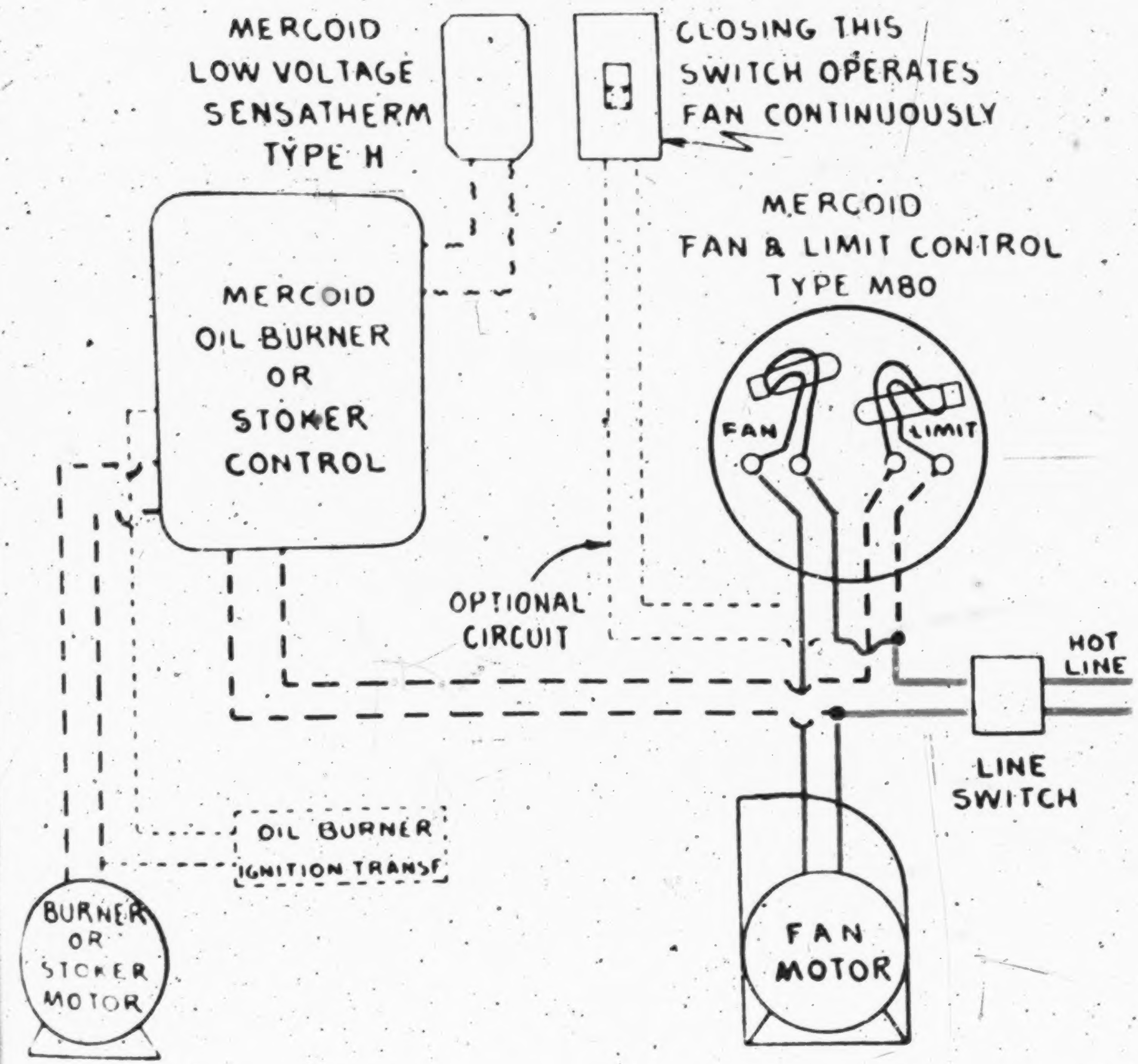
Room thermostat on

Limit switch closed

Fan switch closed

Burner on

Fan on



POSITION 4: ROOM COLD - FURNACE HOT

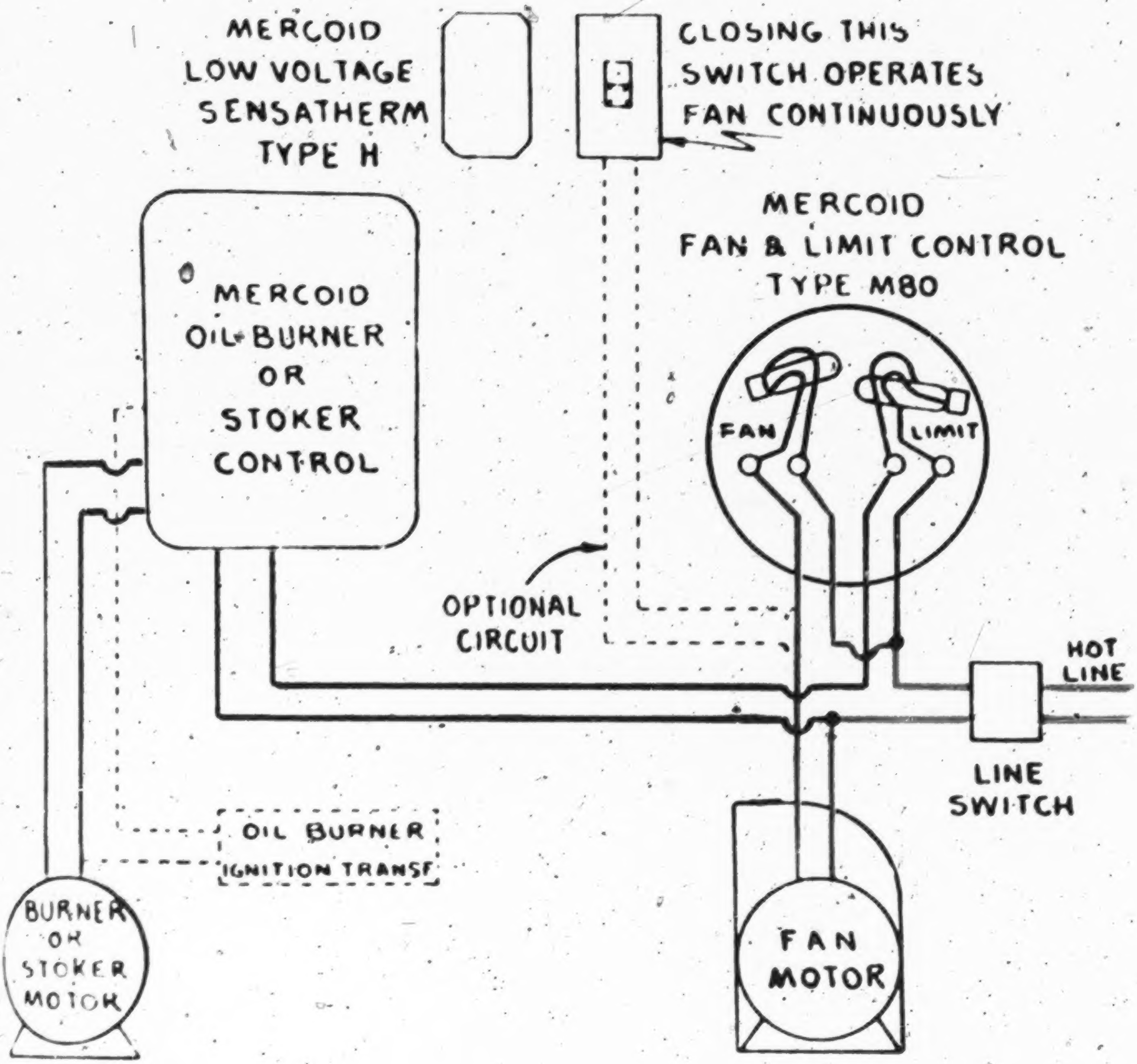
Room thermostat on

Limit switch open

Fan switch closed

Burner off

Fan on



POSITION 5: ROOM COLD - FURNACE WARM

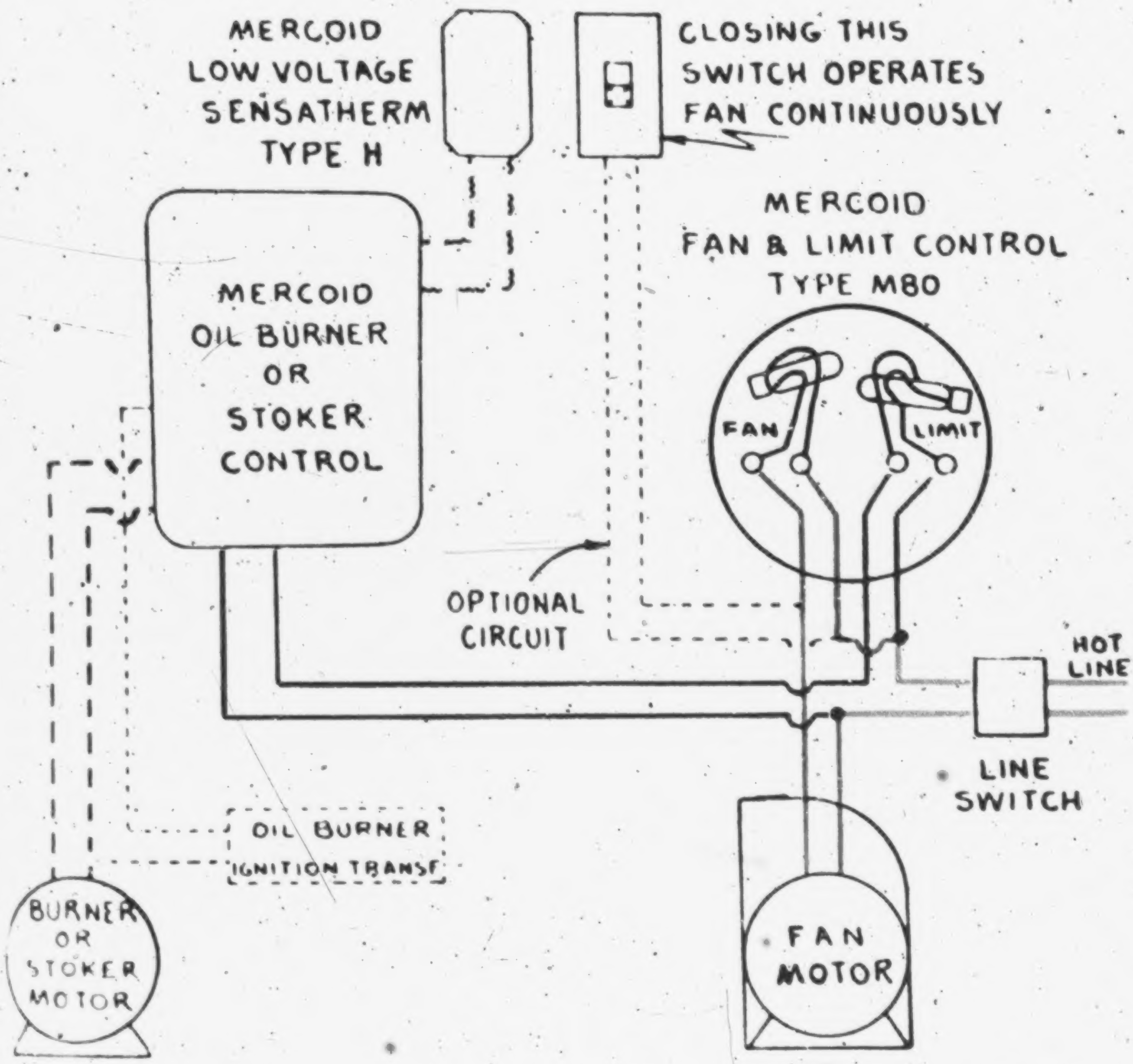
Room thermostat on

Limit switch closed

Fan switch closed

Burner on

Fan on



POSITION 6: ROOM WARM - FURNACE WARM

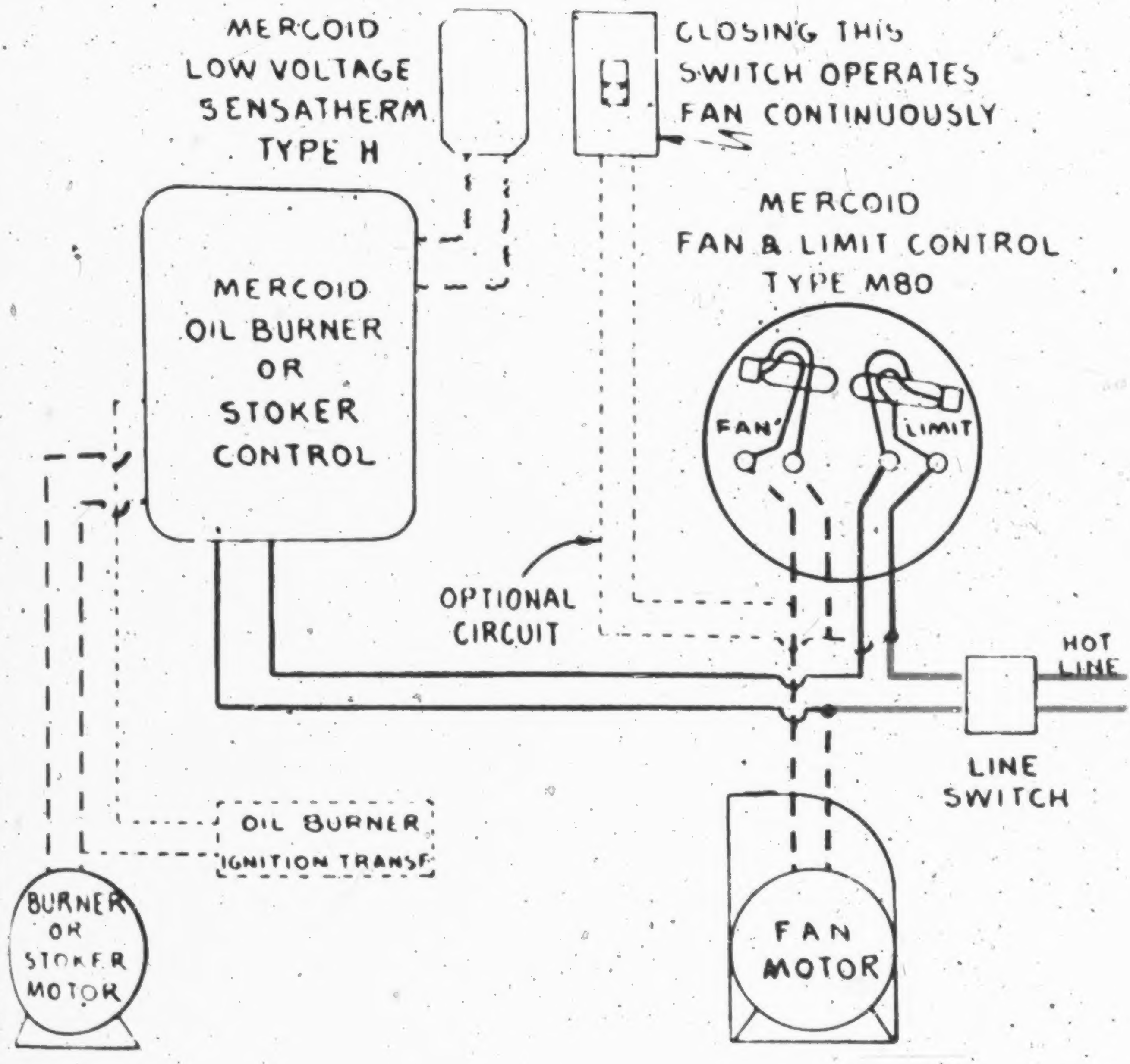
Room thermostat off

Limit switch closed

Fan switch closed

Burner off

Fan on



POSITION 7: ROOM WARM - FURNACE COLD

Room thermostat off

Limit switch closed

Fan switch open

Burner off

Fan off

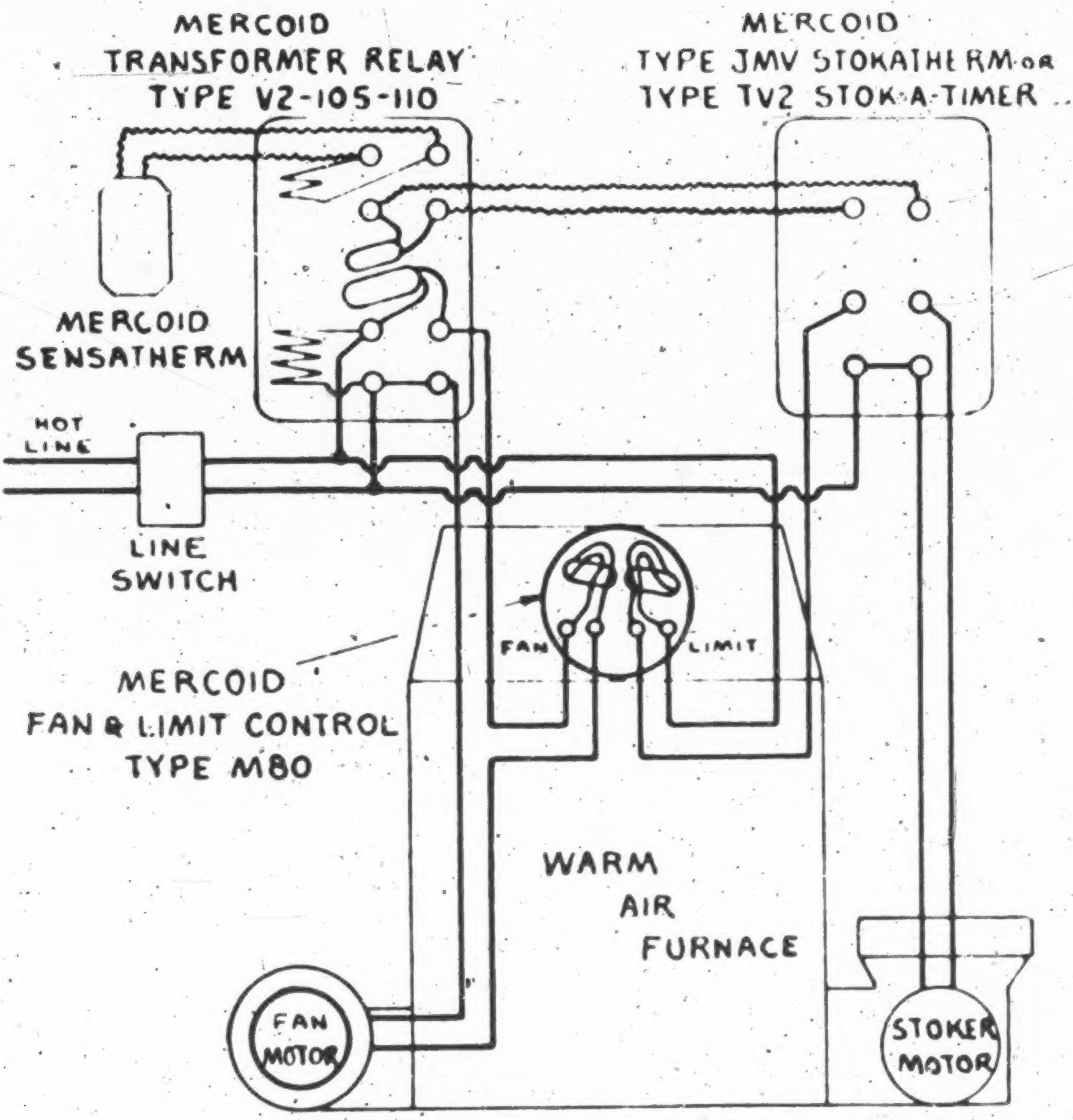
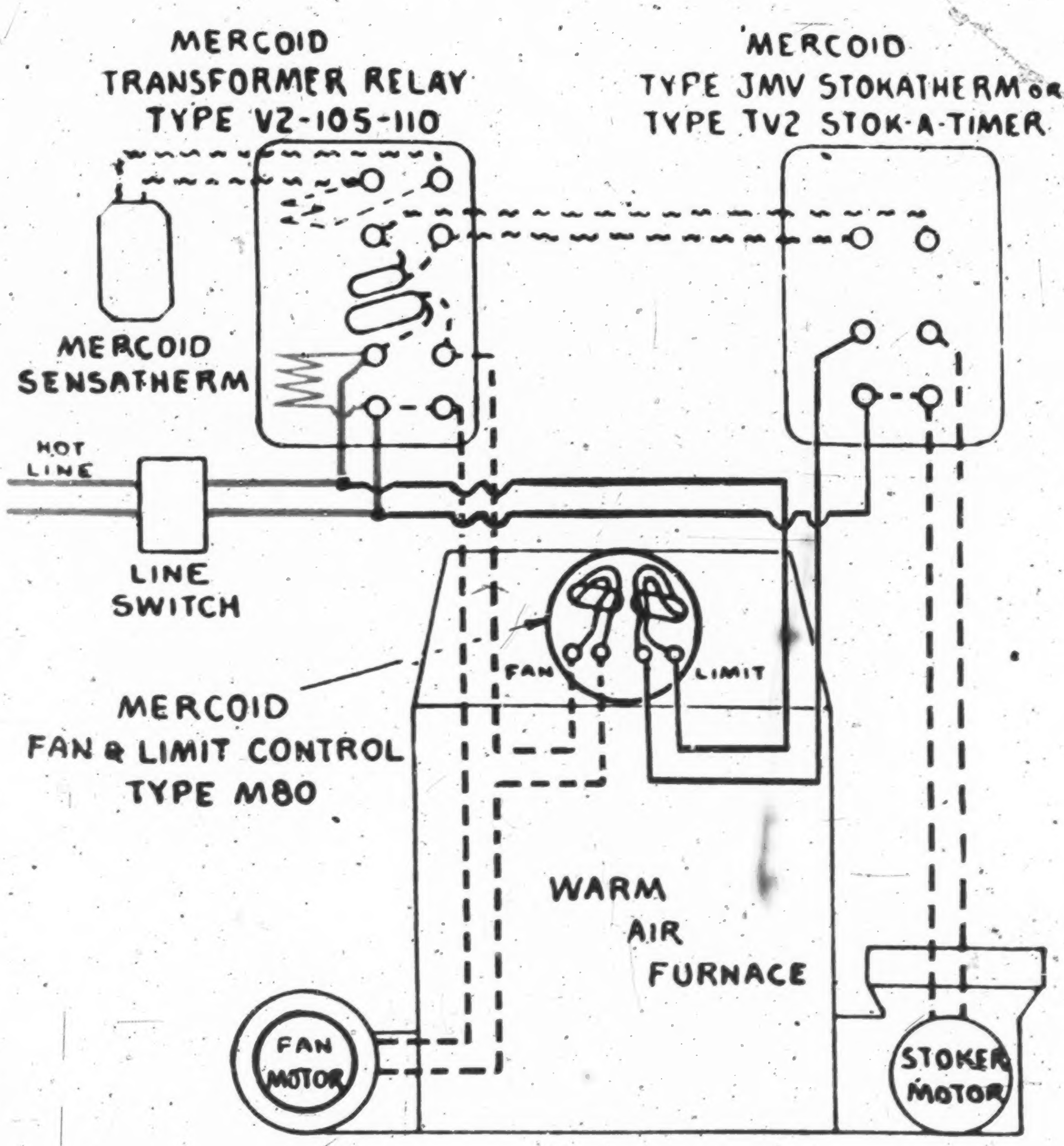


Illustration No. 8

M-H EXHIBIT 3



POSITION 1: ROOM WARM - FURNACE COLD

Room thermostat off

Relay deenergized

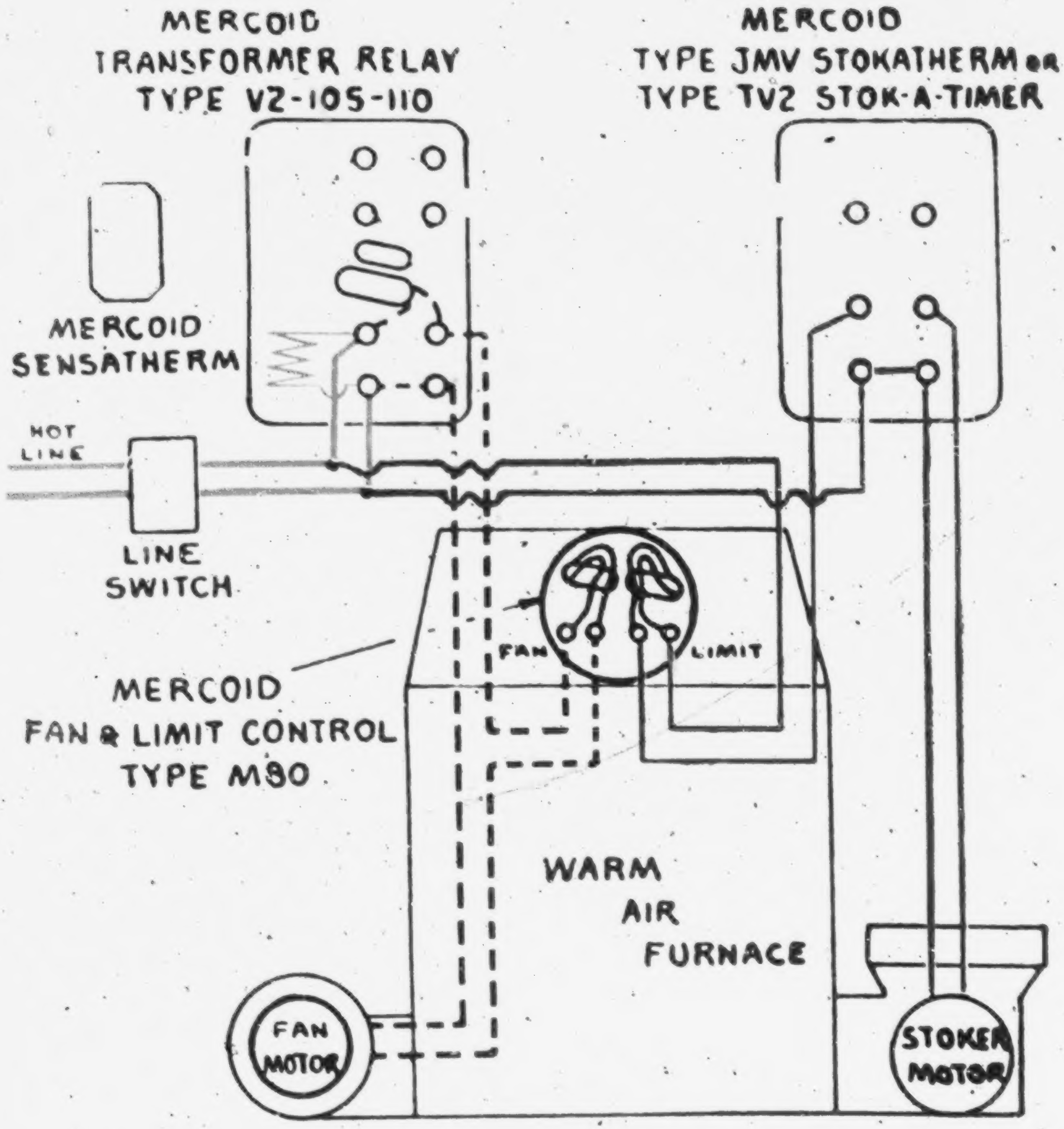
Limit switch closed

Fan switch open

Stoker off

Fan off

EXHIBIT 3a



POSITION 2: ROOM COLD - FURNACE COLD

Room thermostat on

Relay energized

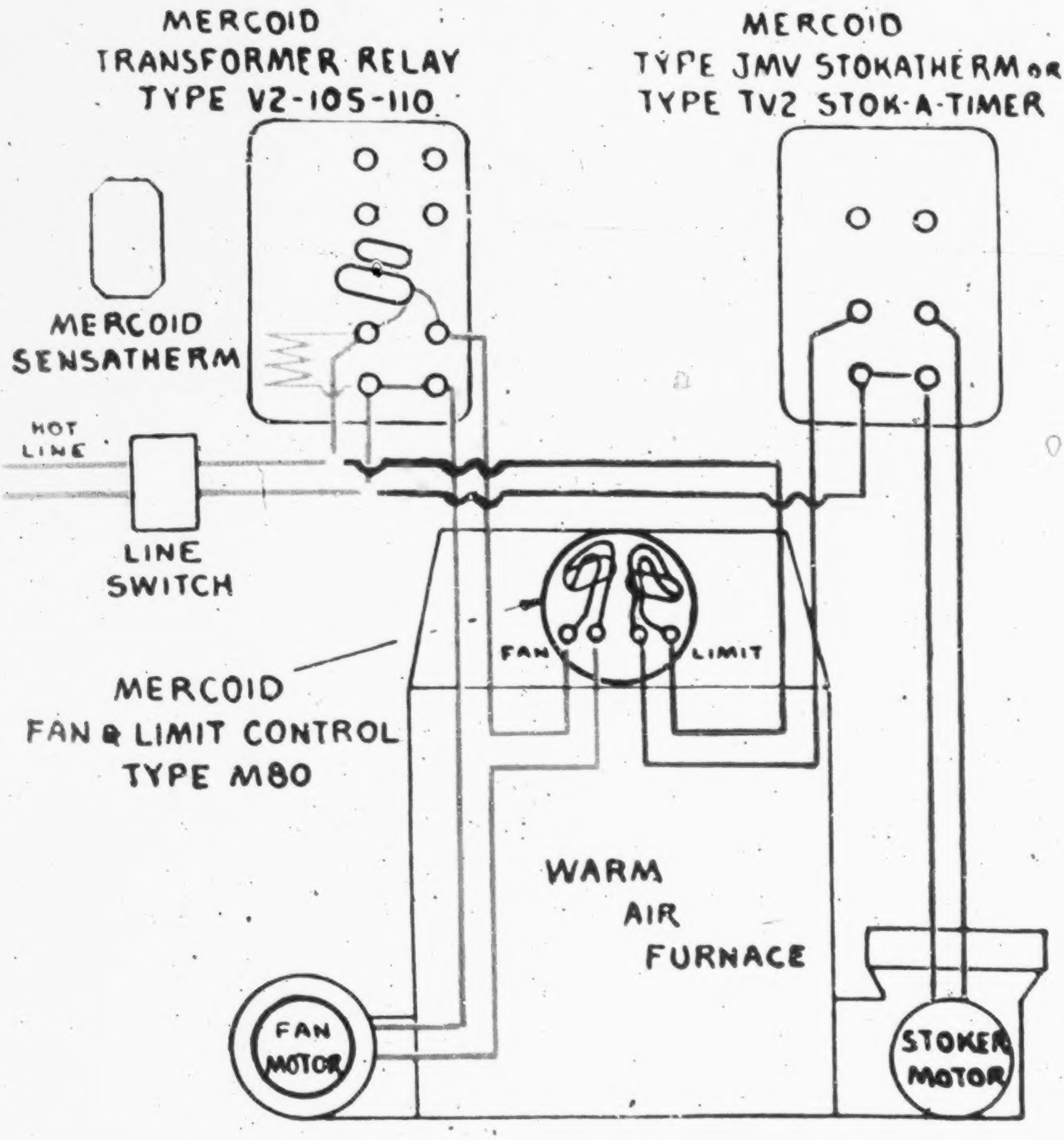
Limit switch closed

Fan switch open

Stoker on

Fan off

M E EXHIBIT 3b



POSITION 3: ROOM COLD - FURNACE WARM

Room thermostat on

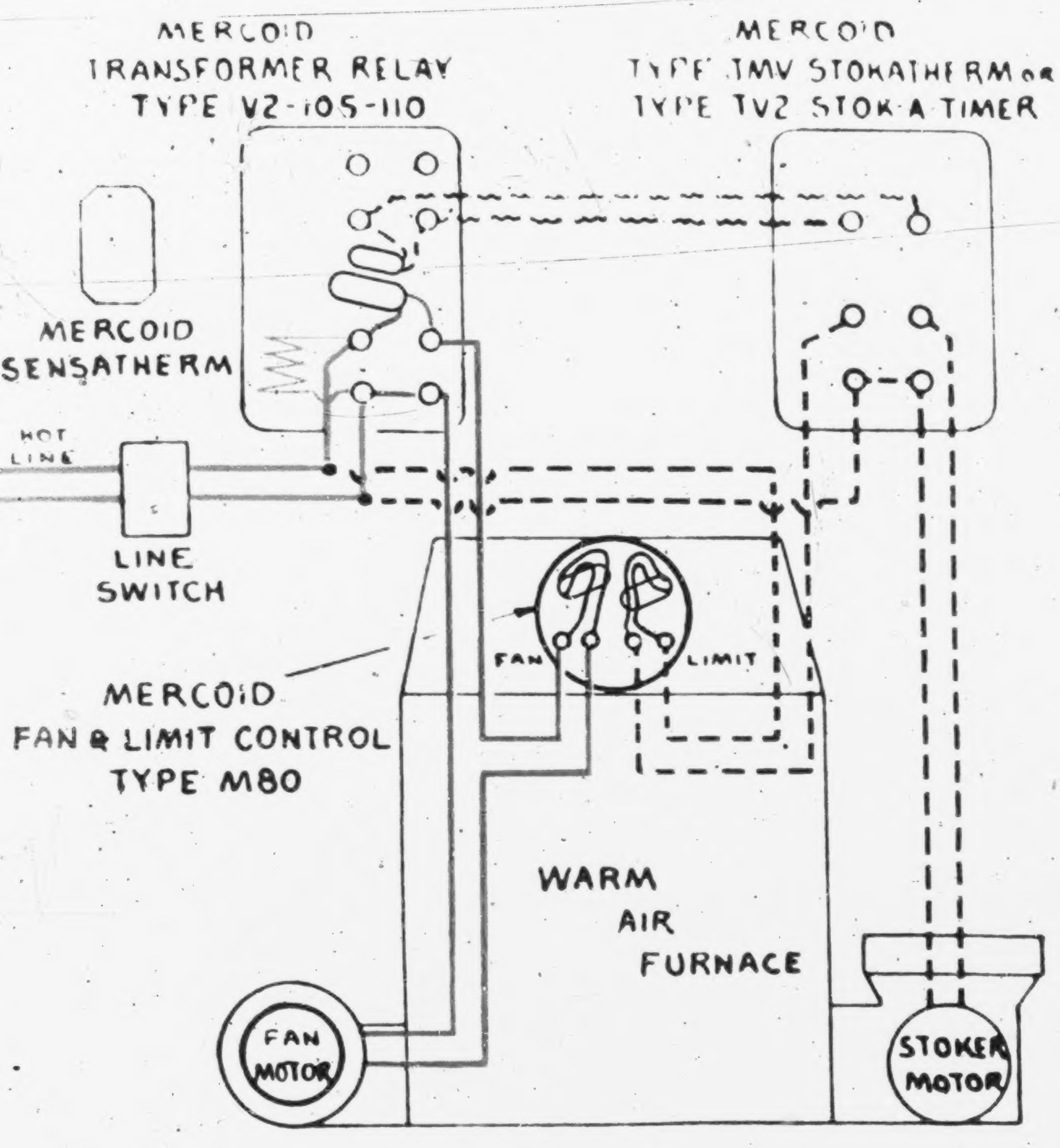
Relay energized

Limit switch closed

Fan switch closed

Stoker on

Fan on



POSITION 4: ROOM COLD - FURNACE HOT

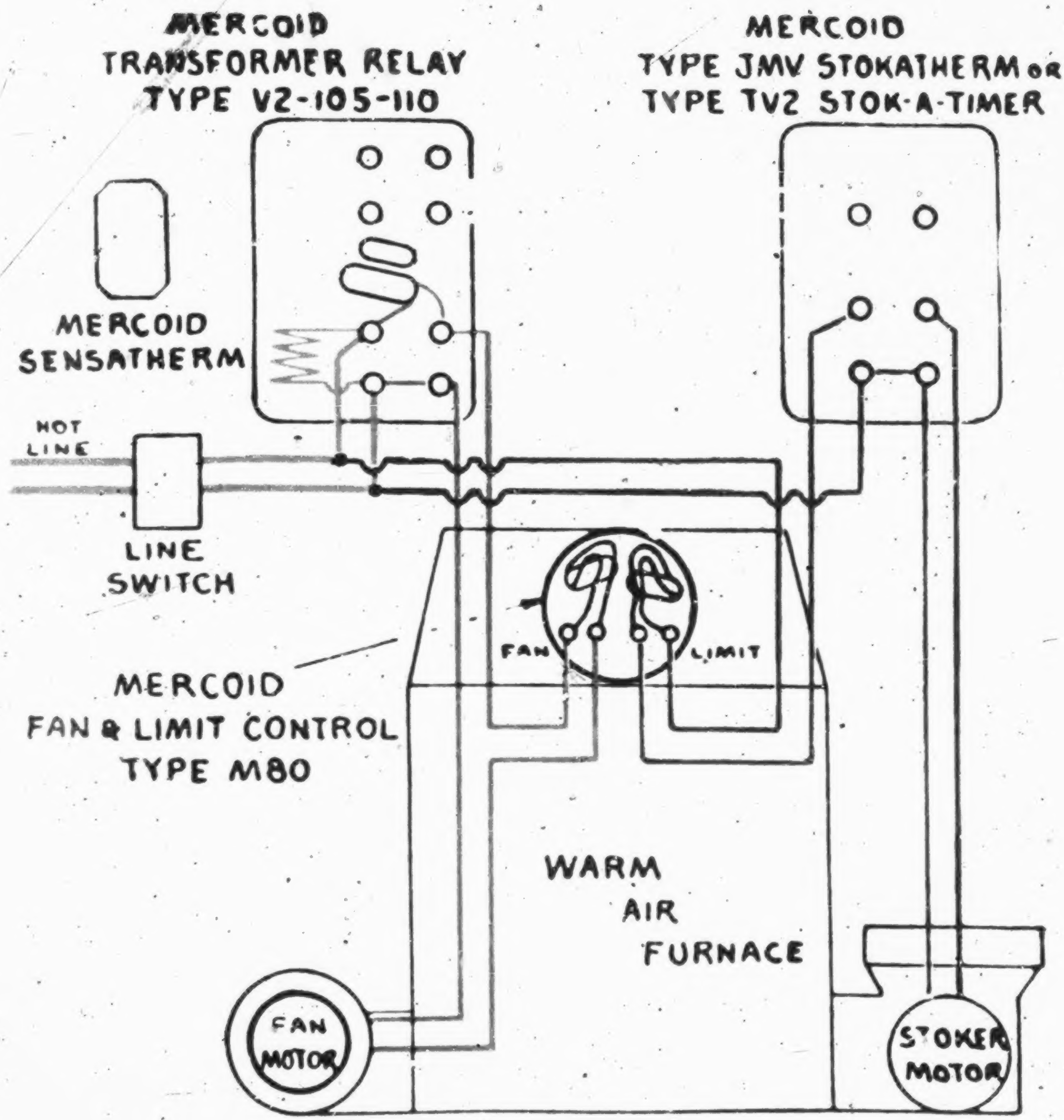
Room thermostat on

Relay energized

Limit switch open

Fan switch closed

Stoker off



POSITION 5: ROOM COLD - FURNACE WARM

Room thermostat on

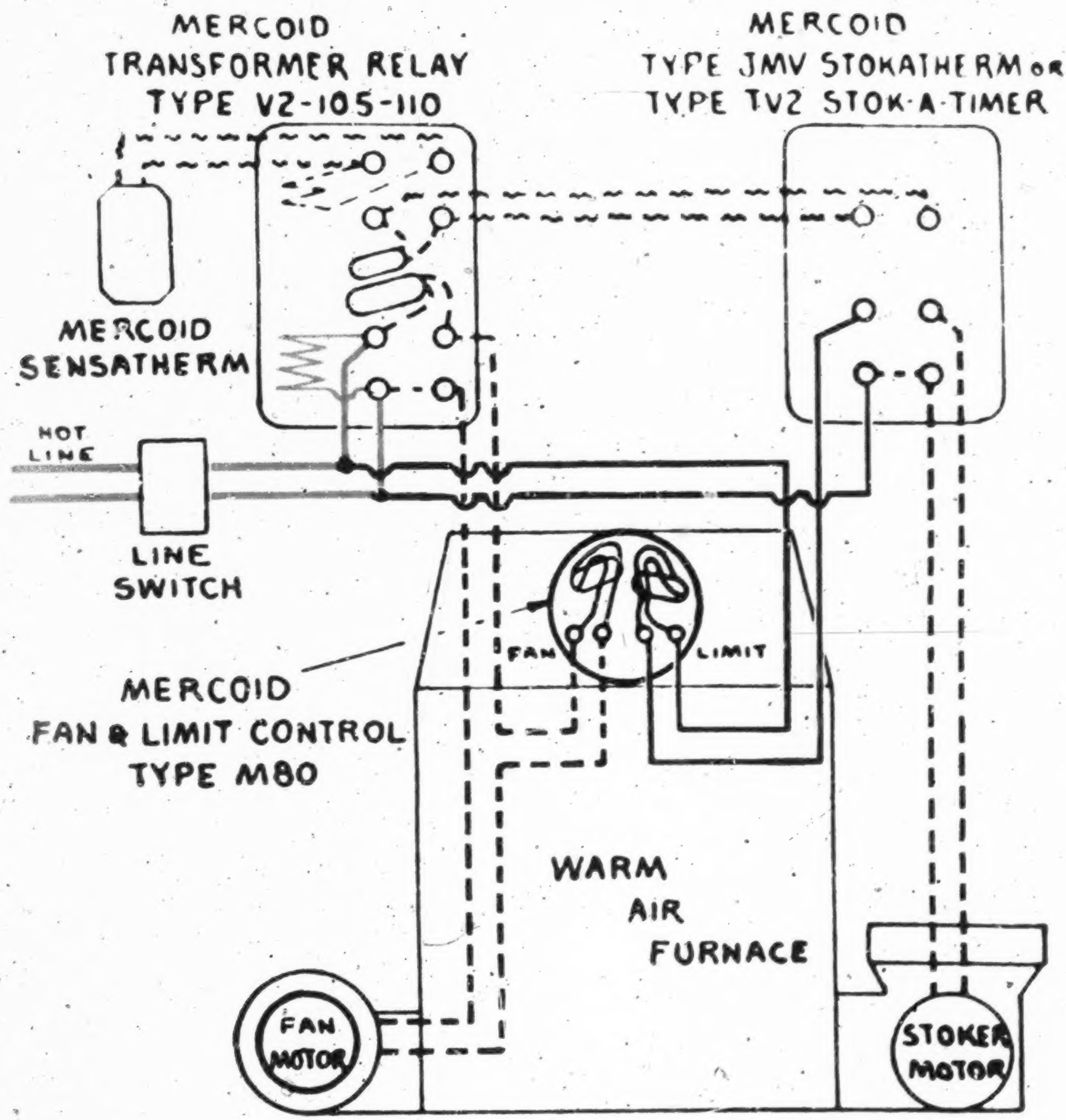
Relay energized

Limit switch closed

Fan switch closed

Stoker on

Fan on



POSITION 6: ROOM WARM - FURNACE WARM

Room thermostat off

Relay deenergized

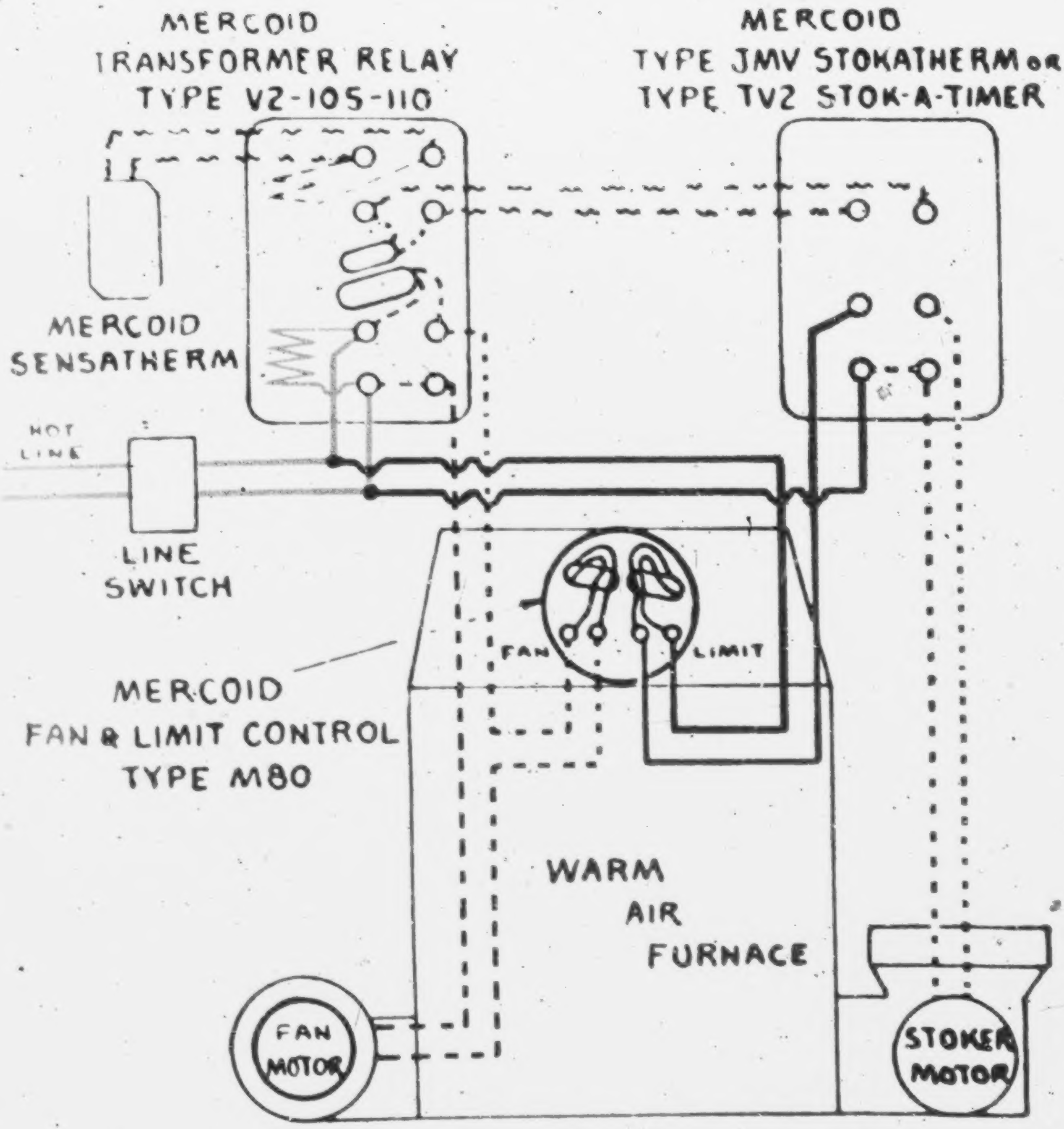
Limit switch closed

Fan switch closed

Stoker off

Fan off

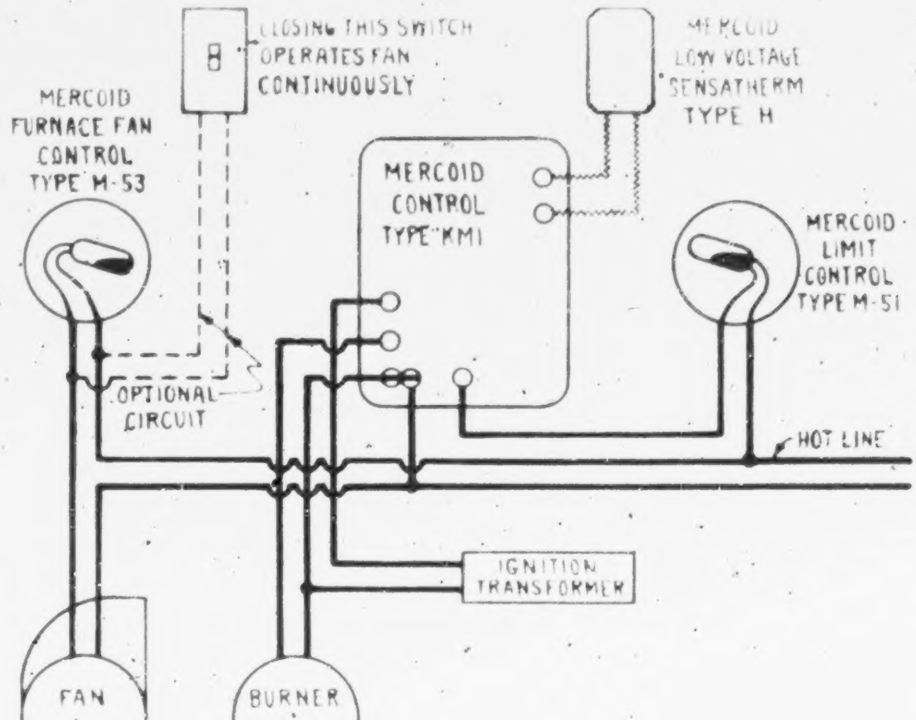
M-H EXHIBIT 3f



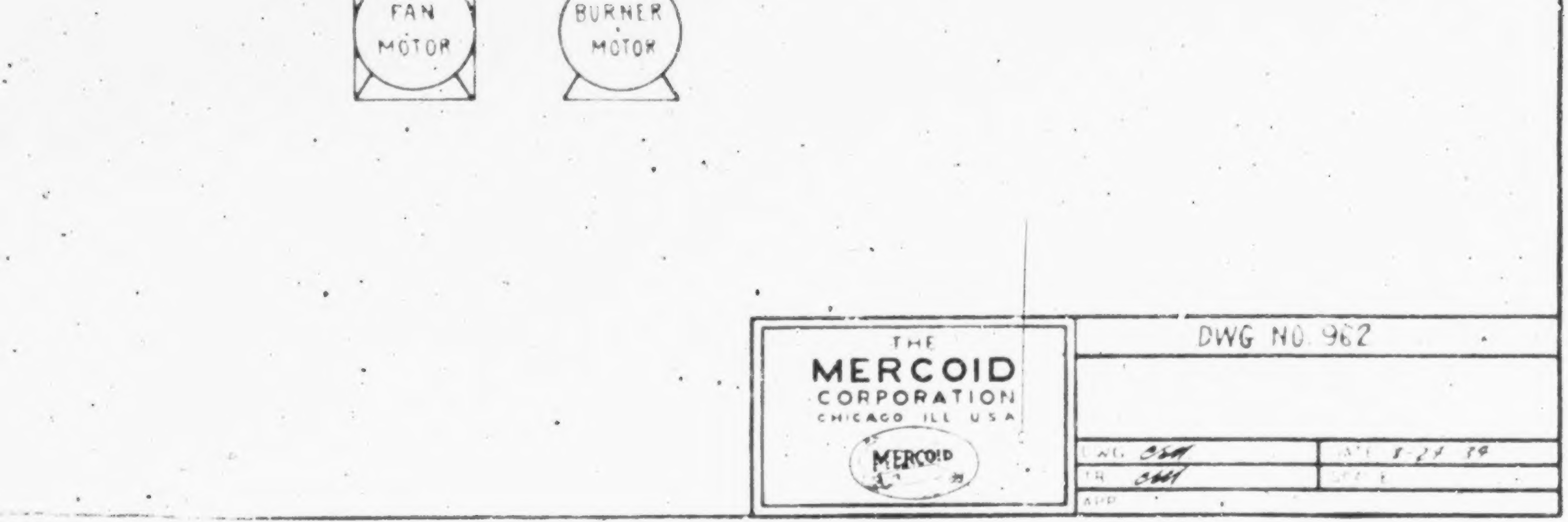
POSITION 7: ROOM WARM - FURNACE COLD

Room thermostat off

Relay [illegible]

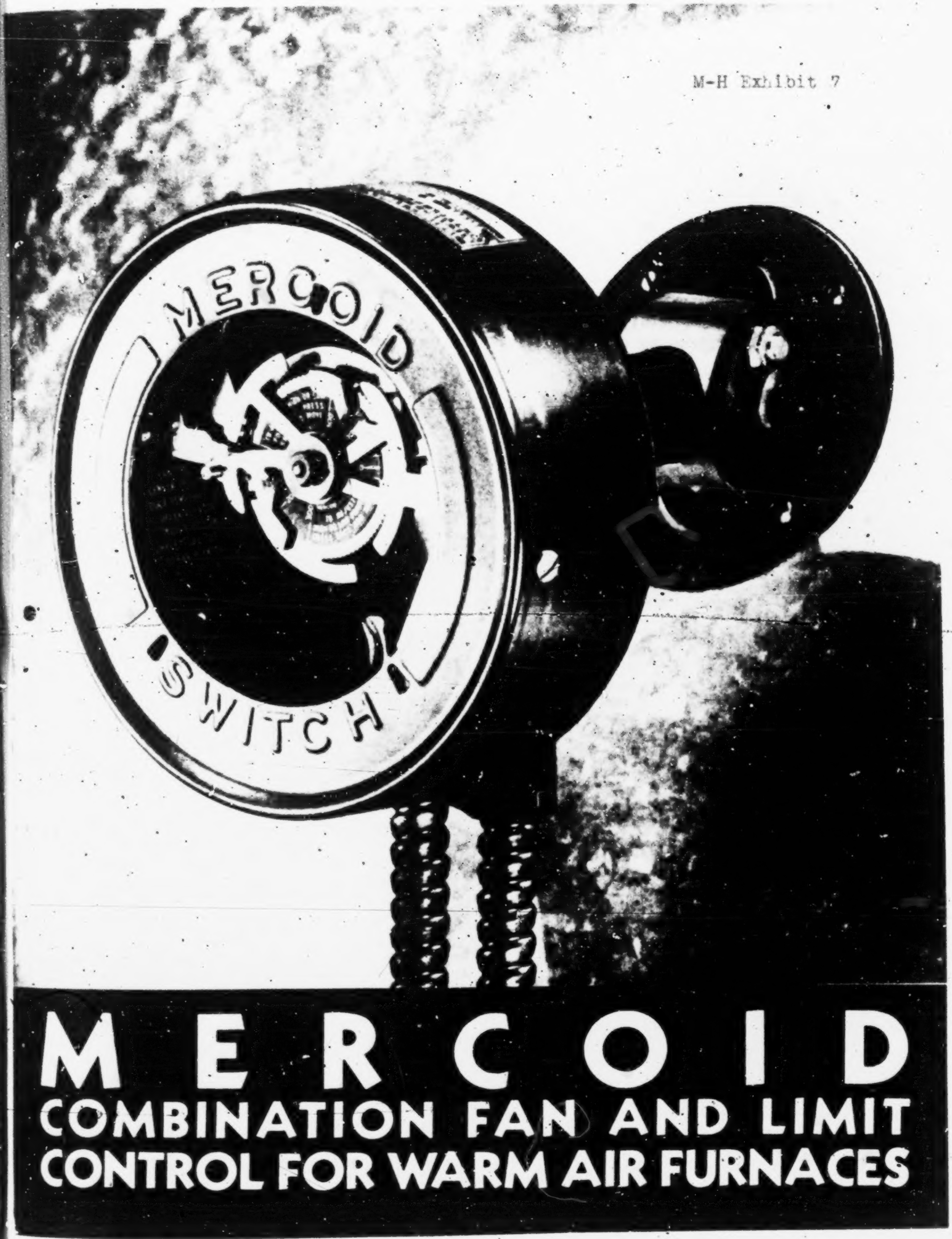


CLOSING THIS SWITCH OPERATES FAN CONTINUOUSLY
MERCOID LOW VOLTAGE SENSATHERM TYPE H
MERCOID FURNACE FAN CONTROL TYPE M-53
MERCOID CONTROL TYPE "KMI
MERCOID LIMIT CONTROL TYPE M-51
OPTIONAL CIRCUIT
HOT LINE
IGNITION TRANSFORMER
FAN
BURNER


FAN MOTOR
BURNER MOTOR
DWG NO. 962
THE MERCOID CORPORATION CHICAGO ILL USA
MERCOID

M-H EXHIBIT 6

M-H Exhibit 7


MERCOID
SWITCH
MERCOID
COMBINATION FAN AND LIMIT
CONTROL FOR WARM AIR FURNACES

MERCOID COMBINATION FAN AND LIMIT CONTROL

Heretofore all automatically fired warm air furnaces equipped with a fan or blower required two separate Mercoid Controls, but these controls may now be had in a single unit in the Mercoid Combination Fan and Limit Control, at a saving over the use of two instruments.

Why a Limit Control is Necessary

The function of a limit control is to protect the furnace from overheating. For example, if the thermostat should be subjected to a cold draft of air from an open window or door, it would cause the electrical circuit of the thermostat to remain closed and continue to call for heat until the cold draft is removed. In the meantime, the oil burner, stoker or gas burner (whatever the case may be) would operate at capacity and very likely result in overheating the furnace, but for the interception of the limit control, which is set at a high predetermined temperature to stop the operation of the heating equipment under such circumstances. However, as soon as the temperature drops to the low predetermined setting of the limit control, the burner will start again, and in this respect, the limit control functions as a thermostat until the abnormal condition surrounding the thermostat is corrected.

The Use of a Fan or Blower Control

The other control, widely used on warm air furnaces, is a fan or blower control, which regulates the operation of a fan or blower.

It is a fact that equipping a warm air furnace with a fan or blower increases the efficiency of the furnace and also economizes on fuel. That is why blower equipped furnaces are rapidly growing in popular favor. They also lend themselves to cooling or air conditioning applications during hot weather. For this type of application, the Mercoid Fan Control has been the accepted control by the trade.

Features of the Mercoid Combination Control

The Mercoid Combination Fan and Limit Control retains all of the outstanding features of the Mercoid Type M-53 Fan Control and Type M-51 Limit Control.

Temperature Indicating Dial

It has a red dial in plain view located at the center of the instrument. The dial is calibrated in Fahrenheit degrees with a scale in duplicate—one scale to each side of the dial. A temperature indicating pointer is provided for each scale to facilitate the reading of the temperature in the furnace hood or duct.

Being able to readily determine the duct temperature has proven to be a popular feature on Mercoid Furnace Controls. It serves the same purpose as a thermometer on boilers. This information enables one to check the proper size of the furnace fire and facilitates making necessary adjustments.

Simplified Double Adjustments

Both "high" and "low" adjustment levers are provided with pointers, which plainly show the operating settings of the fan and limit contol. All adjustments are easily made by simply pressing the finger on the respective levers and moving them to the desired setting as shown in Illustrations No. 1 and No. 2. As the finger is released, the

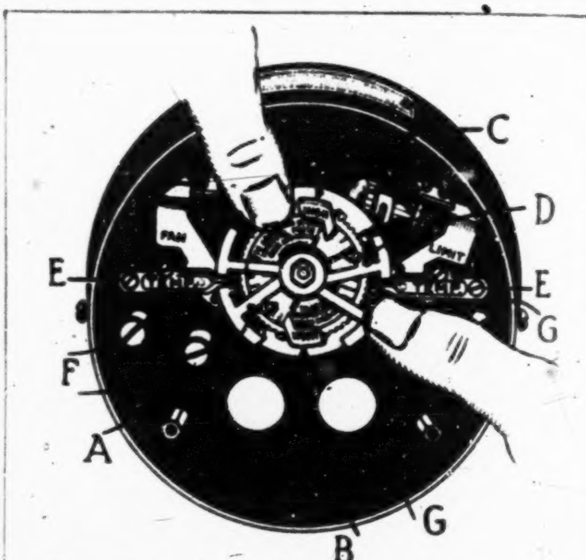


Illustration No. 1
Above illustration shows the detail construction of the control more clearly and the manner the operating adjustments are made. "A" and "B" are the adjustment levers for the fan switch to the left. "C" and "D" for the limit switch to the right. "E-E" temperature indicating pointers. "F" wiring terminals for fan switch. "G" wiring terminals for limit switch. The insulating shield which must be replaced after connections are made is not shown above.

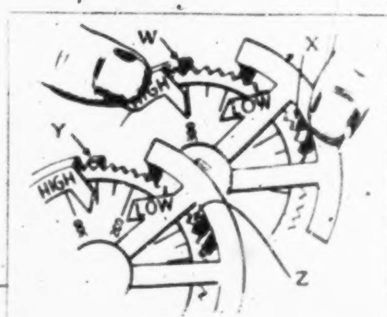


Illustration No. 2
This picture is a detailed illustration showing how the respective high and low adjustment levers "W" and "X" are released from the tooth wheel while pressing adjustments to move them to the required setting. "Y" and "Z" show how they automatically go back into the locking position.

setting is automatically locked in the tooth wheel as shown in Illustration No. 2.

Each lever adjustment is plainly marked, thereby eliminating any possible confusion when setting the operating temperatures for both the fan and limit switches in this control.

Mercury Contact Switches Used

An important consideration when selecting an automatic control is to note the type of switch used. The "making" and "breaking" of an electrical circuit of any control, must be positive to insure trouble-free performance, otherwise, it defeats its own purpose.

Fig. 9-51
Type of Switch used in
Mercoid Combination Fan and Limit Control

There are two hermetically sealed mercury switches used in the Mercoid Combination Control. The one located on the left side, is the fan switch, while the one to the right, is the switch for the limit control.

Mercoid Switches have a number of patented features, which make them outstanding in mercury switch construction. The utmost care and skill are exercised in the making of these switches. Selected material of given specifications must be used throughout. It is amazing to see the amount of detailed attention, operations, tests and inspections that Mercoid Switches are subjected to before they become a working part of a Mercoid Control.

Mercoid Switches cannot be affected by dust, dirt or corrosive gases. They are immune to any adverse surrounding conditions. Millions of these switches have been in the field over a long period of years and are working as perfect today, as when first installed. No cleaning of contacts, or other attention is ever required. There can be no open arcing, pitting of contacts, oxidation or deterioration.

Mercoid Switches are "built to endure," insuring reliable service indefinitely.

Adjustable Mounting Flange

Warm air furnaces usually have a sloping hood which is a characteristic construction, however there is a tendency towards straight-line jacket design in many of the present day types.

All instruments must be placed in a level position to insure proper operation. After a suitable location is determined according to the various field conditions, as shown in Illustration No. 3, a small hole, large enough to permit the insertion of the bimetal stem of the instrument, is cut into the sloped side of the hood.

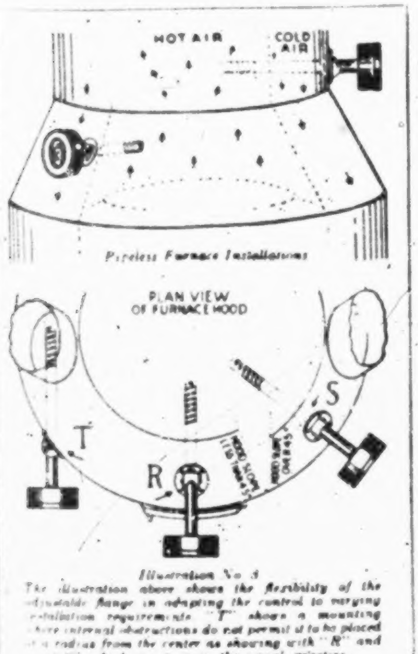


Illustration No. 3
The illustration above shows the flexibility of the adjustable flange in adapting the control to varying installation requirements. "T" shows a mounting where internal obstructions do not permit it to be placed at a radius from the center as showing with "R" and "S" which position is the usual practice.

The Mercoid Combination Fan and Limit Control is provided as standard with a special adjustable mounting flange, which makes it very easy to mount the control within a 30 to 90° angle and then lock it in a fixed position by means of a locking nut. See illustration No. 4.

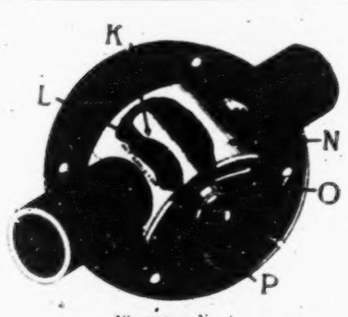


Illustration No. 4
"K" Flange Bolt. "L" Instrument Stem. "N" Retaining Clamp. "O" Locking Nut. "P" Flange Bracket

Flat flange for mounting control on a flat surface and curved flanges for curved surfaces are available on order.

Control Operation

The method of operation of the Mercoid Combination Control is positive, simple and dependable.

The instrument is actuated by means of a helix shaped bimetal coil, which is constant in action, durable in construction and yet very sensitive in its response to temperature changes taking place in the furnace hood.

This bimetal coil serves a two-fold purpose by operating the control mechanism and giving an accurate furnace temperature reading on the dial of the instrument.

A rising temperature rotates the coil in one direction while a dropping temperature rotates it the opposite way. The end of the bimetal is fastened to a shaft, which turns with the coil and operates cams that throw the switches in the "off" and "on" position according to the predetermined settings of the control.

When the temperatures go beyond the control setting, the coil is permitted to turn freely without any strain on the bimetal, therefore, assuring accurate control performance over a long period of time.

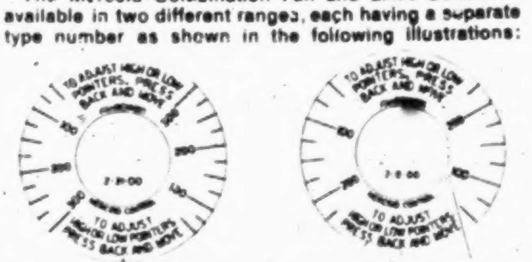
Mercoid Fan and Limit Controls are sturdy in construction, compact and neat in appearance, easy to install and adjust. They give complete all around satisfaction.

Special Requirements Available on Order

In localities where there are ordinances with certain temperature limiting codes that must be complied with, we can furnish stops on the dial, which prevent the adjustment from being set above the specified temperature limitation.

Certain localities require a barrier on a combination control, to keep the high voltage wiring connection separated from the low voltage wires, where both low and high voltage wires come into the same instrument as may be the case when the control is used with a fan and damper motor. The barrier may be applied in the field, and is available upon order.

The Mercoid Combination Fan and Limit Control is available in two different ranges, each having a separate type number as shown in the following illustrations:



The illustration above shows dial with range from 50—300° as used on Type M-80. *The illustration above shows dial with range from 50—225° as used on Type M-82*

List Price

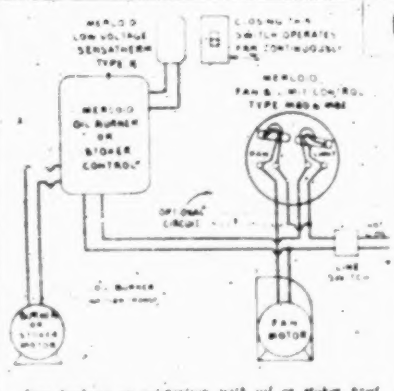
Both instruments are standard for either A.C. or D.C. 10 amp. 110V., 4 amp. 220V., motor rating 1 H.P. Repulsion-Induction. ⅛ H.P. D.C. 110 or 220V., D.C. and ⅛ H.P. split phase.

Type M-80	Range	50—300° F.	15.00
Type M-82	Range	50—225° F.	16.00

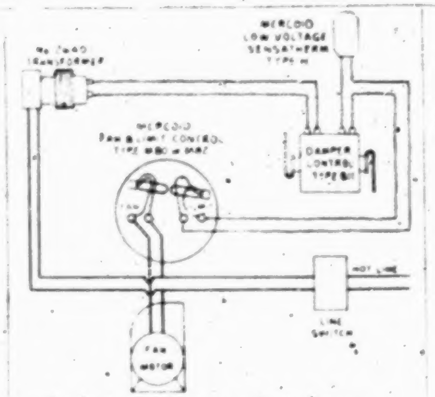
Shipping weight approximately 6 lbs.

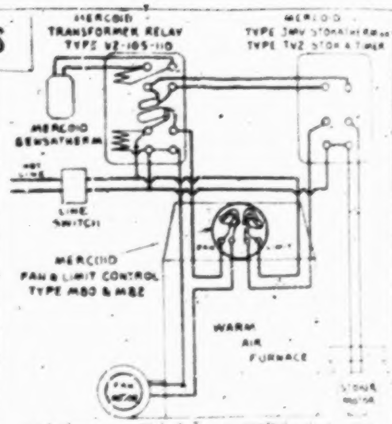
Wiring Diagrams shown on next page

COMBINATION CONTROL WIRING DIAGRAMS



Fan hook-up in connection with oil or stoker fired warm air furnace. Closing optional circuit operates fan continuously for ventilating purposes during summer. With this hook-up after the thermostat is satisfied the fan will continue to run until temperature in the furnace bonnet drops to the control setting.





OTHER MERCOID CONTROLS FOR VARIOUS WARM AIR FURNACE APPLICATIONS

SENSATHERM

DAMPER CONTROL

Whether a warm air furnace has a motor driven damper regulator, automatic oil burner, stoker, or gas burner, a thermostat is used in common on all of the above types of automatic heating equipment.

It is the purpose of the thermostat to stop and start the heating plant in order to maintain an even room temperature in accordance with the setting of the instrument. In this respect, the thermostat is the master control of the heating system and should be selected with care and discrimination, to assure uninterrupted comfort in the home.

The Mercoid Sensatherm meets the most exacting requirements of a room thermostat as it is extremely sensitive and requires no artificial acceleration to keep the home uniformly heated.

It is small in size, neat in appearance and mechanically perfect. The mercury switch used in this temperature control is a positive protection against contact trouble and will operate indefinitely without trouble.

In design and finish, the Sensatherm harmonizes with any scheme of interior decoration.

MERCOID DAMPER CONTROL SETS

The Mercoid Damper Control is designed for reliable automatic regulation of draft and check dampers of heating plants, and is especially recommended for operating duct dampers of zone controlled air conditioning systems.

The popular standard set consists of: Type H Sensatherm, B-11 Damper Control, 110V. 50-60 cycle Transformer and a complete set of accessories ready for installation. Other sets available.

LIMIT CONTROL

FAN CONTROL

SEPARATE LIMIT OR FAN CONTROLS

The Type M-53 Mercoid Fan Control is very popular with the warm air heating trade. Thousands of these controls are in use, giving satisfactory service. This control has a dial and pointer, which plainly indicates the temperature in the furnace hood. It is equipped with a dust-proof sealed mercury contact switch to insure dependable operation at all times. The "high" and "low" operating adjustments are easy to make.

A flange is provided to facilitate installations on different hood angles.

The Mercoid Type M-51 Limit Control has all of the outstanding features of the fan control.

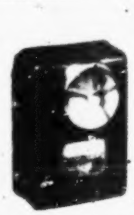
TYPE KMI

TYPE KM

WHERE OIL BURNERS ARE USED

Warm air furnaces automatically fired by an oil burner, require the addition of a safety control to provide protection against flame or ignition failure. The Mercoid KM and KMI Pyratherms are tried and proven safety controls, constructed to give positive protection under all operating conditions. In event of any abnormal conditions, these controls always check to the safe side and stop the burner. Provisions are also made for low voltage protection. These controls are equipped throughout with sealed mercury contact switches to insure years of dependable service. Type KMI (illustration to the left) is for use on burners employing intermittent ignition. Type KM (illustrated to right) is for use on burners with constant ignition. Thousands of these controls are out in the field giving complete satisfaction under varying operating conditions.

STOKATHERM



STOK-A-TIMER

WHERE STOKERS ARE USED

Warm air furnaces fired by a coal stoker require a control to regulate and maintain a low fire while the thermostat is not calling for heat.

The Mercoid Stokatherm has features not found in other stoker controls. It does not depend upon any fixed stack temperature or fixed timing, but in maintaining the fire employs both methods in a new principle of operation. The operation of the control in maintaining the fire is determined by the condition of the fire itself, thus making it possible to maintain a very low fire during this period. Overheating is prevented and fuel is economized. The Stokatherm is for use on anthracite stokers and also for stokers burning a non-coking bituminous coal. This control also has an out-fire feature which prevents feeding coal should the fire go out.

The Mercoid Stok-A-Timer is an improved timer type control and may be used on all types of stokers. It prevents the stoker from operating immediately after the thermostat shuts off. This control is extremely simple to adjust by merely moving a lever over a calibrated dial to the required setting. No tools are required.

THE MERCOID CORPORATION • General Office and Factory, 4201 BELMONT AVE., CHICAGO, ILL.

New York Office: 90 WEST STREET • *Philadelphia Office:* 3137 N. BROAD ST. • *Boston Office:* 25 IVY STREET • *Distributors in All Principal Cities*

Bulletin M-12

IT PAYS TO GET THE BEST

MERCOID

AUTOMATIC CONTROLS

FOR HEATING, AIR CONDITIONING, REFRIGERATION AND VARIOUS TYPES OF INDUSTRIAL APPLICATIONS

CATALOG NUMBER 300

PRICES EFFECTIVE MAY 1, 1939

Subject to Change Without Notice

ABC FIVE LETTER CODE-FIFTH EDITION USED IN THIS CATALOG

THE MERCOID CORPORATION

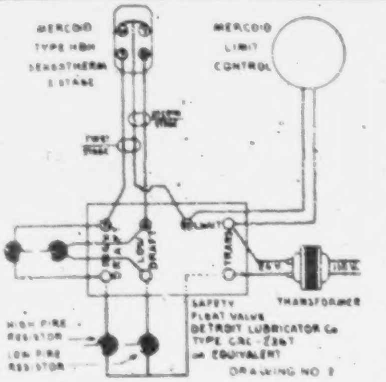
MAIN OFFICE AND FACTORY • 4201 BELMONT AVE • CHICAGO, ILL., U.S.A.

NEW YORK OFFICE 330 W 34th ST • PHILADELPHIA OFFICE 3137 N BROAD ST • BOSTON OFFICE 25 BUSWELL ST.

Sole Manufacturers of The Mercoid Switch

M-H EXHIBIT 8

WIRING DIAGRAMS APPLYING TO MERCOID TWO-STAGE SENSATHERMS



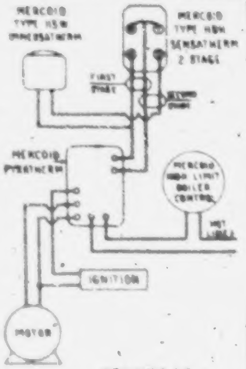
DRAWING NO 2

Above diagram covers a typical hook up of two stage thermostatic control of high low fire vaporizing type oil burners. When room temperatures are low both circuits of the Sensatherm are closed and the burner operates at high fire. As the temperature rises the first stage circuit opens and burner goes to low fire operation. If the temperature continues to rise, the second stage circuit opens cutting down the fire to only the pilot flame.

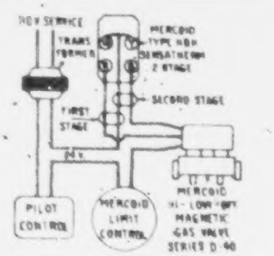
The hook up shown provides a method of control which minimizes room temperature stratification.

The first stage of the Type HBH Sensatherm is directly connected to the Mercoid Pyratherm and normally operates the burner to maintain the desired room temperature.

Room temperature stratification is minimized by maintaining a constant circulation of hot water thru the system. This is accomplished by connecting the Type 115W Immersotherm (installed in radiator or return) in series with the second stage of the Sensatherm. During periods when temperatures at the breathing line are normal (1st stage circuit open) should the water temperature get low, the Type 115W Immersotherm will close its circuit and the burner will operate to increase the water temperature so that circulation will continue. During very mild weather, should the sustained low temperature at the radiators cause the room temperature to increase above normal, the second stage of the Sensatherm will open, thus preventing further operation of the burner and eliminating overheating.

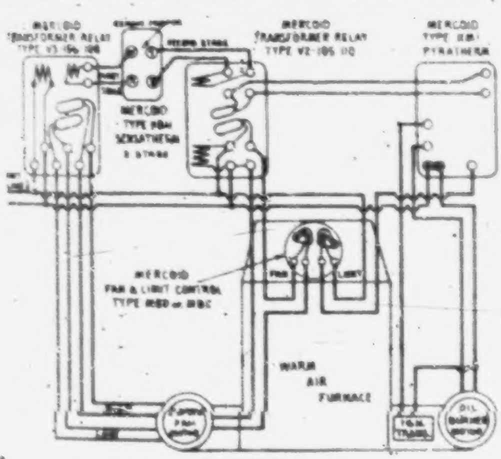


DRAWING NO 3



DRAWING NO 4

Above diagram covers a typical hook up of two stage thermostatic control of high low fire gas burners. When room temperatures are low both circuits of the Sensatherm are closed and the gas burner operates at high fire. As the room temperature rises to the thermostat setting the 1st stage circuit opens which causes the main part of gas valve to close. If temperature continues to rise, the 2nd stage circuit opens and the valve closes completely cutting burner down to only the pilot flame.



DRAWING NO 5

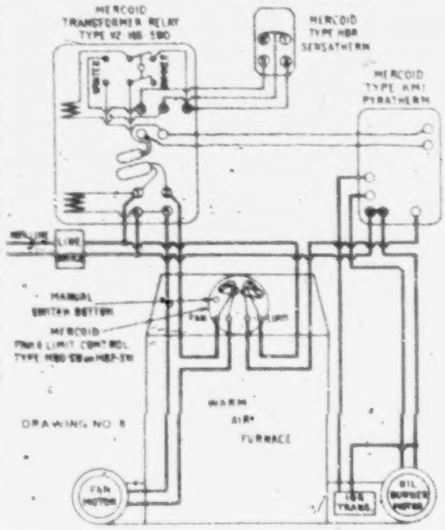
In the past it has been common practice to control two speed fans on warm air systems from changes of bonnet temperature. The above diagram covers an application where the operation of the heating equipment as well as the two speeds of the fan are regulated from the room thermostat.

This particular diagram covers an oil fired system, however the same general hook-up is also adaptable to stoker fired or gas fired equipment. A typical hook-up is shown in the connections to the two speed fan motor. This hook up may vary with different makes of motors, however, the relays shown may generally be employed.

When the room temperature is low, both circuits of the two stage Sensatherm are closed. This causes the burner to operate. The fan also will operate at high speed if the furnace is up to temperature (fan switch closed). As the temperature rises, the 1st stage circuit of the thermostat opens and causes the fan motor to operate at low speed. The burner will continue to operate but if excessive temperature is generated at the furnace due to the fan operating only at low speed, the limit control will stop the burner. If the room temperature should continue to rise, the 2nd stage circuit of the thermostat will open and stop both the burner and circulating fan. On a drop in room temperature, the 2nd stage thermostat circuit closes which starts the burner and operates the fan at low speed. If the heat demand is low, the room temperature will be maintained by the fan operating at low speed, however, should the room temperature continue to drop the 1st stage circuit of the thermostat will close and operate the fan at high speed.

Relay Type V2-105-580 has a built in toggle switch projecting through the cover. When thrown to the "Winter" position, the heating circuit of Sensatherm HBR controls the operation of both the burner motor and circulating fan. When the room temperature is below the setting of the Sensatherm, the burner will operate continuously unless the furnace bonnet reaches the temperature at which the limit control is set. When the bonnet reaches the temperature for which the fan switch is set, the fan will operate but will stop immediately when the room reaches the required temperature.

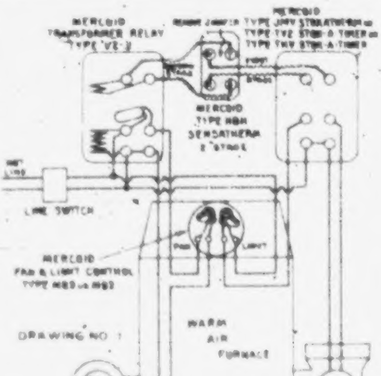
By throwing the toggle switch of the relay to the "Summer" position the low voltage circuit to the KMI Pyratherm is opened so that the burner cannot operate. At the same time the cooling circuit of the HBR Sensatherm is connected to Relay Type V2-105-580. By closing the summer switch on the fan control, the fan will operate at any time the room temperature is above the Sensatherm setting.



DRAWING NO 6

Diagram to right, covers the application of a two stage thermostat on a stoker fired warm air system with forced circulation. The thermostat independently controls the operation of both the stoker and circulating fan. When the room temperature is low both circuits of the thermostat are closed causing both the stoker and circulating fan to operate. As the temperature rises, the first stage circuit of the thermostat stops the stoker but the fan continues to operate. If the temperature continues to rise, the second stage circuit of the thermostat opens and stops the fan. When the temperature begins lowering the fan alone starts operating (stoker does not operate) and if the temperature again rises the fan stops. The fan continues operating intermittently and alone, unless temperatures continue to drop, when the stoker is again started.

The Fan Switch prevents operation of the fan, and circulation of cold air, whenever the furnace is not up to temperature. The Limit Switch stops the stoker, at any time temperatures at the furnace become excessive. The Stok-A-Timer can operate, to prevent the stoker fire going out, at any time the thermostat circuit remains open.



DRAWING NO 7

WARM AIR FURNACE CONTROLS

EQUIPPED WITH THE MERCOID SEALED MERCURY CONTACT SWITCH

TYPE M-51 MERCOID WARM AIR LIMIT CONTROLS

TYPE M-51

SIDE VIEW

The Mercoid Warm Air Limit Control is neat in appearance and is sturdily constructed thruout to render long and dependable service in the field. Its use is recommended on all furnace installations to prevent overheating.

The Mercoid switch is of the enclosed mercury contact type. It is not subject to open arcing, corrosion, oxidation, or pitting and will operate indefinitely without deterioration. The mechanism of this control has many outstanding features. The dial, located in the center of the instrument, slowly rotates as the temperature on the bi-metal coil increases or decreases. This dial is clearly calibrated in degrees Fahrenheit, and a pointer indicates the temperature in the furnace or duct,—enabling the installation or service men to check the proper size of fire.

A simple double adjustment is provided for setting both the "high" and "low" operating points. The range can be adjusted over the entire scale, and the differential can be set for very close operation, or may be widened to meet any field requirements.

The flange provided permits mounting of this control on any furnace hood, as it is adjustable for any angle between 30 and 90 degrees. Easily installed by means of the four sheet metal screws provided.

SPECIFICATIONS

TYPE M-51: Available in standard ranges 25 to 300°F., or 50 to 500°F. Recommended as limit control on installations where minimum temperature codes are not in effect. Single pole—circuit opens on rise in temperature.

TYPE M-51D: Recommended on all installations where local code requirements or The National Board of Fire Prevention and A.G.A. specifications are enforced. Stop pins on dial prevent setting cut-out temperature higher than 200°F. Range adjustable 25 to 200°F. Single pole—circuit opens on rise in temperature.

TYPE M-52L: Two circuit low voltage—one circuit opens as other circuit closes. Recommended for use with 3 wire damper motors or other series "20" equipment. Capacity 5 amp.—25 volt. Standard range 50 to 500°F.

AIR CONDITIONING TYPES: Where an air conditioning installation must conform to National Board of Fire Underwriters' regulations (Rule 172 pamphlet 90) for the prevention of propogation of fire thru ducts passing thru fire walls, refer to Types M-51S and M-51R (page 20) which have been especially designed for this service.

ELECTRICAL CAPACITY: Standard single pole instruments 10 amp. 115V., 5 amp. 230V. (Available on special order 3 amp. 440V.—add to list $3.00).

MOTOR RATING: 1 H.P. Repulsion-Induction, ½ H.P. Split-Phase or D.C.

SPECIAL CIRCUITS: Available double pole or two circuit—see page 45 for ordering data and addition to list price.

TYPE NO	RANGE ADJ	CODE	LIST PRICE
M-51	25-300° F.	utoow	$8.00
M-51	50-500° F.	utopx	8.00
M-51D	50-200° F.	utoqy	8.00
M-52L	50-500° F.	utosa	8.00

With Centigrade graduations
Code "utiin" No extra charge

Shipping weight approx. 5 lbs.

TYPE M-53 MERCOID WARM AIR FAN CONTROL

TYPE M-53

The Mercoid Warm Air Fan Control is neat in appearance and is sturdily constructed thruout to render long and dependable service in the field. Its use is recommended to control the operation of air circulating or booster fans. This instrument operates the fan economically and prevents blowing cold air into the room if furnace is not hot enough to deliver heat.

The Mercoid switch is of the enclosed mercury contact type. It is not subject to open arcing, corrosion, oxidation, or pitting and will operate indefinitely without deterioration. The mechanism of this control has many outstanding features. The dial, located in the center of the instrument, slowly rotates as the temperature on the bi-metal coil increases or decreases. This dial is clearly *calibrated in degrees Fahrenheit,* and a pointer indicates the temperature in the furnace or duct,—enabling the installation or service men to check the fan operation.

A simple double adjustment is provided for setting both the "high" and "low" operating points. The range can be adjusted over the entire scale, and the differential can be set for very close operation, or may be widened to meet any field requirements.

The flange provided permits mounting of this control on any furnace hood, as it is adjustable for any angle between 30 and 90 degrees. Easily installed by means of the four sheet metal screws provided.

SPECIFICATIONS

TYPE M-53: Standard ranges 25 to 300°F., or 50 to 500°F. Circuit closes as temperature rises. Recommended for installations where minimum temperature codes are not in effect.

TYPE M-53D: Recommended on all installations where local code requirements or The National Board of Fire Prevention and A.G.A. specifications are enforced. Stop pins on dial prevent setting fan cut-in temperature higher than 175°F. Range adjustable 25 to 175°F. Circuit closes as temperature rises.

TYPE M-53SW: Same as Type M-53 except is equipped with lock type manual-switch button. Turning button locks switch in "on" position and permits operation of fan during summer months for ventilating purposes. When furnace is again fired and temperature rises, manual switch automatically unlatches and restores control to normal operation. Standard ranges 25 to 300°F., or 50 to 500°F. Circuit closes as temperature rises.

TYPE M-53SWD: Combination of Type M-53SW and M-53D listed above. Stop pins on dial prevent setting fan cut-in temperature higher than 175°F., and summer switch is included. Range adjustable 25 to 175°F. Circuit closes as temperature rises.

ELECTRICAL CAPACITY: Standard single pole instruments, 10 amp. 115V., 5 amp. 230V. either A.C. or D.C. (Available on special order 3 amp. 440V.—add to list $3.00).

MOTOR RATING: 1 H.P. Repulsion Induction, ½ H.P. Split Phase or D.C.

SPECIAL CIRCUITS: Available double pole or two circuit—see page 45 for ordering data and addition to list price.

TYPE NO	RANGE ADJ	CODE	LIST PRICE
M-53	25-300° F	utotb	$8.00
M-53	50-500° F	utouc	8.00
M-53D	25-175° F	utovd	8.00
M-53SW	25-300° F	utowe	8.50
M-53SW	50-500° F	utoxf	8.50
M-53SWD	25-175° F	utoyg	8.50

With Centigrade graduations
Code "utiin" No extra charge

Shipping weight approx. 5 lbs.

COMBINATION FAN AND LIMIT WARM AIR CONTROLS

EQUIPPED WITH THE MERCOID SEALED MERCURY CONTACT SWITCH

TYPE M-80

SIDE VIEW TYPE M-80 SHOWING ADJUSTABLE FLANGE

STRAIGHT NON-ADJUSTABLE MOUNTING FLANGE

TYPE M-80 COMBINATION FAN AND LIMIT CONTROL —WITH SUMMER SWITCH

Four Adjustments provided for Independently Setting the Cut-in and Cut-out Temperatures of Both the Fan and Limit Switches.

The Type M-80 Mercoid Warm Air control is a duplex instrument, combining within one case all of the well known field proven features of the Type M-51 Limit Control and the Type M-53 Fan Control. This instrument is recommended for air conditioning systems or other warm air applications employing forced circulation and automatic heating equipment. The limit switch opens its circuit on rising temperatures and protects the furnace against overheating. The fan switch, which closes its circuit on rising temperatures, regulates the operation of the fan and prevents blowing cold air into the rooms if the furnace is not hot enough to deliver heat.

The mechanism of this control has many outstanding features. A red dial, located in the center of the instrument, slowly rotates as the temperature changes on the bimetal coil. This dial is clearly calibrated in Fahrenheit degrees with a scale in duplicate—one scale for the limit switch settings, the other for the fan switch settings. A temperature indicating pointer is provided which indicates, on the graduated dial, the temperature in the furnace or duct. Serving the same purpose as a thermometer this temperature indicator enables installation or service men to check the proper size of fire when making necessary adjustments.

Four simple adjustments are provided for independently setting the cut-in and cut-out temperatures of both the fan and limit switches. The differentials can be set for very close operation or can be widened to meet any field requirement.

The Mercoid enclosed mercury contact switches are not subject to open arcing, corrosion, oxidation or pitting and operate indefinitely without deterioration.

This instrument is provided as standard with a special adjustable flange which permits mounting on any furnace hood, where the angle is from 30 to 90 degrees. Easily installed by means of four sheet metal screws provided. For air conditioning units with flat surfaces, can be furnished on special order with flat non-adjustable flange as illustrated at reduced cost when ordered in quantities—Prices on application.

ALL TYPES STANDARD WITH SUMMER SWITCH

All Combination Controls are furnished standard with lock type manual switch button. Turning button locks fan switch in "on" position and permits operation of fan during summer months for ventilating purposes. When furnace is again fired and temperature rises manual switch automatically unlatches and restores control to normal operation.

LINE VOLTAGE INSTRUMENTS

The following instruments are for general applications where the limit switch and fan switch are required to directly control motors at line voltage.

TYPE M-80—For general applications. Range adjustable from 50 to 300° F.

TYPE M-82—For general applications requiring very close differentials. This instrument is equipped with longer bi-metal operating coil for more sensitive operation. Range adjustable from 50 to 225° F.

TYPE M-84—Complies with A.G.A. ruling and Detroit ordinance limiting operating temperatures of warm air furnaces. Equipped with long sensitive bi-metal coil but stop pins are provided which limit Fan Switch adjustments to 175° F. and Limit Switch adjustments to 200° F.

LINE VOLTAGE FAN SWITCH—LOW VOLTAGE LIMIT SWITCH

The following instruments are for applications where the fan is to be directly controlled at line voltage and where the limit switch is to control low voltage equipment such as gas valves, damper controls etc. As both line voltage and low voltage enter the same case a steel barrier with low voltage cable clamp is provided between the terminal posts in accordance with requirements of Underwriter's Laboratories, Inc.

TYPE M-80B—Same as Type M-80 except with barrier. Range 50 to 300° F.

TYPE M-82B—Same as Type M-82 except with barrier. Range 50 to 250° F.

TYPE M-84B—Same as Type M-84 except with barrier. Fan switch range 50 to 175°. Limit switch 50 to 200° F.

ELECTRICAL CAPACITY (Each Circuit): 10 amp. 115 Volt, 5 amp. 230 Volt, A.C. or D.C.

MOTOR RATING (Each Circuit): 1 H.P. Repulsion Induction, ½ H.P. Split Phase or D.C.

LINE VOLTAGE CONTROLS

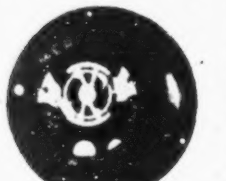
TYPE NO	RANGE ADJ	CODE	LIST PRICE
M-80	50 to 300°	uvfuh	$11.00
M-82	50 to 225°	uvfvi	12.00
M-84	Fan 50 to 175° Limit 50 to 200°	uvfyl	12.00

LINE VOLTAGE—LOW VOLTAGE

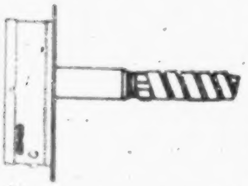
TYPE NO	RANGE ADJ	CODE	LIST PRICE
M-80B	50 to 300°	uvfzm	$11.00
M-82B	50 to 225°	uvgac	12.00
M-84B	Fan 50 to 175° Limit 50 to 200°	uvgbd	12.00

Furnished standard with adjustable mounting flange. Can be furnished to manufacturers on special order with non-adjustable flat flange at reduced cost when ordered in quantities—Prices on application.

Shipping weight approx. 6 lbs.



TYPE M-80F



SIDE VIEW TYPE M-80F

TYPE M-80F COMBINATION FAN AND LIMIT CONTROL

WITH FLANGED CASE—FOR DIRECT ATTACHMENT TO FURNACE JACKETS

Type M-80F Mercoid Combination Fan and Limit Controls incorporate the summer switch as well as all of the desirable adjustment features of the Type M-80 listed above. They are, however, supplied with flanged case for direct attachment to furnace jackets. Type M-80F controls are especially recommended for use in connection with furnace burner units which have a flat vertical surface. The appearance of the furnace is greatly improved by the flange mounting, and all wiring is concealed behind the furnace jacket.

STANDARD FINISH: Hard rubber black enamel.

SPECIAL FINISHES: To manufacturers requiring quantities the Type M-80F can be furnished with special finish to match furnace jacket. Prices on application.

STANDARD SLEEVE LENGTH: Standard stock instruments have an overall length from the back of the instrument case to the end of the bimetal coil as follows: Types M-80F and M-80BF—[illegible] inches. Types M-84F and M-84BF—[illegible] inches. Available to manufacturers in quantities with special sleeve lengths as desired. Prices on application.

LINE VOLTAGE INSTRUMENTS

The following instruments are for general applications where the limit switch and fan switch are required to directly control motors at line voltage.

TYPE M-80F—For general applications. Range adjustable from 50 to 300° F.

TYPE M-84F—Complies with A.G.A. ruling as well as Detroit ordinance limiting the operating temperatures of warm air furnaces. Equipped with long sensitive bi-metal coil but stop pins are provided which limit Fan Switch adjustments to 175° F. and Limit Switch adjustments to 200° F.

LINE VOLTAGE FAN SWITCH—LOW VOLTAGE LIMIT SWITCH

The following instruments are for applications where the fan is to be directly controlled at line voltage and where the limit switch is to control low voltage equipment such as gas valves, damper controls etc. As both line voltage and low voltage enter the same case a steel barrier with low voltage cable clamp is provided between the terminal posts in accordance with requirements of Underwriter's Laboratories, Inc.

TYPE M-80BF—Same as Type M-80F except with barrier. Range 50 to 300° F.

TYPE M-84BF—Same as Type M-84F except with barrier. Fan switch range 50 to 175°. Limit switch 50 to 200° F.

ELECTRICAL CAPACITY AND MOTOR RATING same as Type M-80 shown above.

LINE VOLTAGE CONTROLS

TYPE NO	RANGE ADJ	CODE	LIST PRICE
M-80F	50 to 300°	uvgce	$10.25
M-84F	Fan 50 to 175° Limit 50 to 200°	uvgeg	11.25

LINE VOLTAGE—LOW VOLTAGE

TYPE NO	RANGE ADJ	CODE	LIST PRICE
M-80BF	50 to 300°	uvggi	$10.25
M-84BF	Fan 50 to 175° Limit 50 to 200°	uvgik	11.25

NOTE: Special net prices quoted manufacturers requiring quantities.

Shipping weight approx. 6 lbs.

MERCOID AUTOMATIC CONTROLS

FOR HEATING, AIR CONDITIONING, REFRIGERATION AND VARIOUS TYPES OF INDUSTRIAL APPLICATIONS

CATALOG NUMBER 400

PRICES EFFECTIVE FEBRUARY 1, [illegible]

Subject to Change Without Notice

CABLE ADDRESS: MERCOID CHICAGO
CODE: ABC FIVE LETTER FIFTH EDITION

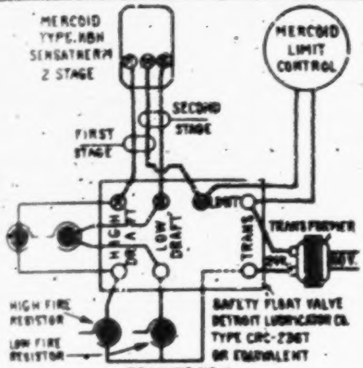
THE MERCOID CORPORATION

MAIN OFFICE AND FACTORY • 4201 BELMONT AVE. • CHICAGO, ILL., U.S.A.

NEW YORK OFFICE 330 W 34th ST • PHILADELPHIA OFFICE 3137 N. BROAD ST • BOSTON OFFICE 839 BEACON ST

Sole Manufacturers of The Mercoid Switch

WIRING DIAGRAMS APPLYING TO MERCOID TWO-STAGE SENSATHERMS



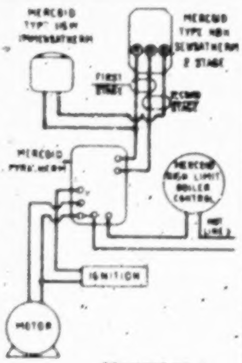
DRAWING NO. 2

Above diagram covers a typical hook-yp of two stage thermostatic control of high-low fire vaporizing type oil burners. When room temperatures are low both circuits of the Sensatherm are closed and the burner operates at high fire. As the temperature rises the first stage circuit opens and burner goes to low fire operation. If the temperature continues to rise, the second stage circuit opens cutting down the fire to only the pilot flame.

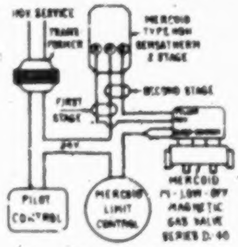
The hook-up shown provides a method of control which minimizes room temperature stratification.

The first stage of the Type HBH Sensatherm is directly connected to the Mercoid Pyratherm and normally operates the burner to maintain the desired room temperature.

Room temperature stratification is minimized by maintaining a constant circulation of hot water thru the system. This is accomplished by connecting the Type 115W Immersatherm (installed in radiator or return) in series with the second stage of the Sensatherm. During periods when temperatures at the breathing line are normal (1st stage circuit open), should the water temperature get low, the Type 115W Immersatherm will close its circuit and the burner will operate to increase the water temperature so that circulation will continue. During very mild weather, should this sustained low temperature at the radiators cause the room temperature to increase 1° above normal, the second stage of the Sensatherm will open, thus preventing further operation of the burner and eliminating overheating.

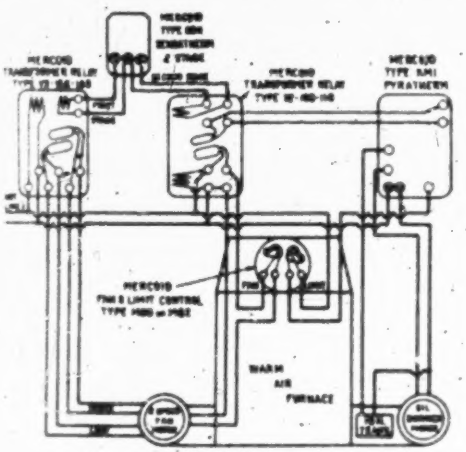


DRAWING NO 3



DRAWING NO. 4

Above diagram covers a typical hook-up of two-stage thermostatic control of high-low fire gas burners. When room temperatures are low both circuits of the Sensatherm are closed and the gas burner operates at high fire. As the room temperature rises to the thermostat setting the 1st stage circuit opens, which causes the main port of gas valve to close. If temperature continues to rise, the 2nd stage circuit opens and the valve closes completely cutting burner down to only the pilot flame.



DRAWING NO. 5

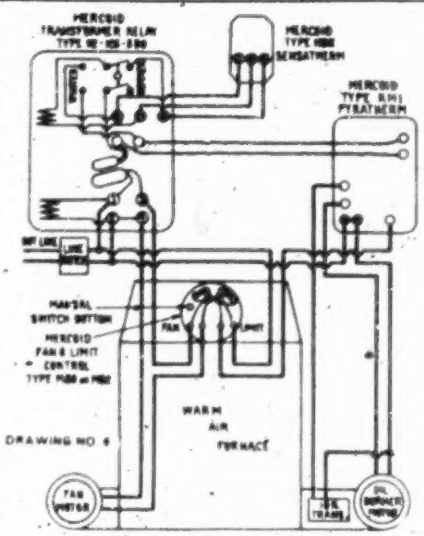
In the past it has been common practice to control two speed fans on warm air systems from changes of bonnet temperature. The above diagram covers an application where the operation of the heating equipment, as well as the two speeds of the fan are regulated from the room thermostat.

This particular diagram covers an oil fired system, however, the same general hook-up is also adaptable to stoker fired or gas fired equipment. A typical hook-up is shown in the connections to the two speed fan motor. This hook-up may vary with different makes of motors, however, the relays shown may generally be employed.

When the room temperature is low, both circuits of the two stage Sensatherm are closed. This causes the burner to operate. The fan also will operate at high speed if the furnace is up to temperature (fan switch closed). As the temperature rises, the 1st stage circuit of the thermostat opens and causes the fan motor to operate at low speed. The burner will continue to operate but if excessive temperature is generated at the furnace, due to the fan operating only at low speed, the limit control will stop the burner. If the room temperature should continue to rise, the 2nd stage circuit of the thermostat will open and stop both the burner and circulating fan. On a drop in room temperature, the 2nd stage thermostat circuit closes which starts the burner and operates the fan at low speed. If the heat demand is low, the room temperature will be maintained by the fan operating at low speed, however, should the room temperature continue to drop the 1st stage circuit of the thermostat will close and operate the fan at high speed.

Relay Type V2-106-590 has a built-in toggle switch projecting through the cover. When thrown to the "Winter" position the heating circuit of Sensatherm HBR controls the operation of both the burner motor and circulating fan. When the room temperature is below the setting of the Sensatherm the burner will operate continuously unless the furnace bonnet reaches the temperature at which the limit control is set. When the bonnet reaches the temperature for which the fan switch is set, the fan will operate but will stop immediately when the room reaches the required temperature.

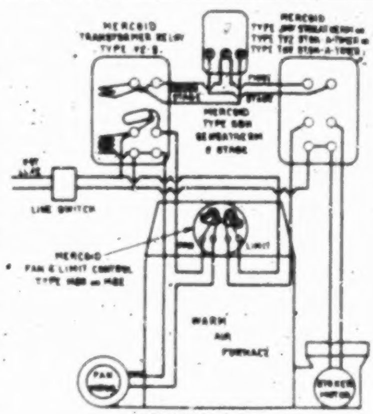
By throwing the toggle switch of the relay to the "Summer" position the low voltage circuit to the KMI Pyratherm is opened so that the burner cannot operate. At the same time the cooling circuit of the HBR Sensatherm is connected to Relay Type V2-106-590. By closing the summer switch on the fan control, the fan will operate at any time the room temperature is above the Sensatherm setting.



DRAWING NO 6

Diagram to right, covers the application of a two stage thermostat on a stoker fired warm air system with forced circulation. The thermostat independently controls the operation of both the stoker and circulating fan. When the room temperature is low both circuits of the thermostat are closed causing both the stoker and circulating fan to operate. As the temperature rises, the first stage circuit of the thermostat stops the stoker but the fan continues to operate. If the temperature continues to rise, the second stage circuit of the thermostat opens and stops the fan. When the temperature begins lowering the fan alone starts operating (stoker does not operate) and if the temperature again rises the fan stops. The fan continues operating intermittently and alone, unless temperatures continue to drop when the stoker is again started.

The Fan Switch prevents operation of the fan, and circulation of cold air, whenever the furnace is not up to temperature. The Limit Switch stops the stoker, at any time temperatures at the furnace become excessive. The Stok-A-Timer can operate, to prevent the stoker fire going out, at any time the thermostat circuit remains open.



DRAWING NO 7

WARM AIR FURNACE CONTROLS

EQUIPPED WITH THE MERCOID SEALED MERCURY CONTACT SWITCH

TYPE M-51

SIDE VIEW

TYPE M-51 MERCOID WARM AIR LIMIT CONTROLS

The Mercoid Warm Air Limit Control is neat in appearance and is sturdily constructed thruout to render long and dependable service in the field. Its use is recommended on all furnace installations to prevent overheating.

The Mercoid switch is of the enclosed mercury contact type. It is not subject to open arcing, corrosion, oxidation, or pitting and will operate indefinitely without deterioration. The mechanism of this control has many outstanding features. The dial, located in the center of the instrument, slowly rotates as the temperature on the bi-metal coil increases or decreases. This dial is clearly calibrated in degrees Fahrenheit, and a pointer indicates the temperature in the furnace or duct,—enabling the installation or service men to check the proper size of fire.

A simple double adjustment is provided for setting both the "high" and "low" operating points. The range can be adjusted over the entire scale, and the differential can be set for very close operation, or may be widened to meet any field requirements.

The flange provided permits mounting of this control on any furnace hood, as it is adjustable for any angle between 30 and 90 degrees. Easily installed by means of the four sheet metal screws provided.

SPECIFICATIONS

TYPE M-51: Available in standard ranges 25 to 300°F., 50 to 500°F., or 50 to 650°F. Recommended as limit control on installations where minimum temperature codes are not in effect. Single pole—circuit opens on rise in temperature.

TYPE M-51D: Recommended where local code requirements or The National Board of Fire Prevention specifications are enforced. Range adjustable 25 to 200°F. Single pole—circuit opens on rise in temperature.

TYPE M-51G: Complies with A.G.A. ruling limiting operating temperatures of warm air furnaces. Range adjustable 25 to 250°F. Single pole—circuit opens on rise in temperature.

AIR CONDITIONING TYPES: Where an air conditioning installation must conform to National Board of Fire Underwriters' regulations (Rule 172 pamphlet 90) for the prevention of propogation of fire thru ducts passing thru fire walls, refer to Types M-51S and M-51R (page 23) which have been especially designed for this service.

TYPE M-52L: Two circuit low voltage—one circuit opens as other circuit closes. Recommended for use with 3 wire damper motors or other series "20" equipment. Capacity 4 amp.—25 volt. Standard range 50 to 500°F.

ELECTRICAL CAPACITY: Standard single pole instruments 10 amp.-115V., 5 amp. 230V. Not available for 440V.

MOTOR RATING: 1 H.P. Repulsion-Induction, ½ H.P. Split-Phase or D.C.

SPECIAL CIRCUITS: Available double pole or two circuit—see page 56 for ordering data and addition to list price.

TYPE NO.	RANGE ADJ.	CODE	LIST PRICE
M-51	25-300° F.	utoow	$7.00
M-51	50-500° F.	utopx	7.00
M-51	50-650° F.	uvkei	7.00
M-51D	50-200° F.	utoqy	7.00
M-51G	25-250° F.	uvojp	7.00
M-52L	50-500° F.	utosa	8.00

With Centigrade graduations—
Code "utin" No extra charge

Shipping weight approx. 5 lbs.

TYPE 116 MERCOID DUCTATHERM

LOW VOLTAGE WARM AIR LIMIT CONTROL

Type 116 Mercoid Ductatherm is recommended as a limit control for warm air systems where the equipment controlled is of the low voltage type such as damper motors or gas valves.

The Ductatherm has an external dial calibrated from 50 to 300°F. To set the operating range it is merely necessary to move the external adjustment pointer to the required temperature.

The wiring is simplified as three terminals are provided as well as two low voltage cable bushings. Either series or multiple hook-ups can be made without splicing any connections.

Furnished standard with 9 inch extension sleeve. Available on special order (no extra charge) with 4½ inch sleeve length. Available only with flat mounting flange.

ELECTRICAL CAPACITY: Low Voltage—6/10th amp., 24 volt.

TYPE NO.	RANGE ADJ.	CODE	LIST PRICE
116	50-300° F.	utozh	$ 7.00

For Centigrade graduations
Code "utin" No extra charge

Shipping weight approx. 3 lbs.

TYPE M-53

TYPE M-53SW MERCOID WARM AIR FAN CONTROL

FURNISHED STANDARD WITH SUMMER SWITCH

The Mercoid Warm Air Fan Control is neat in appearance and is sturdily constructed thruout to render long and dependable service in the field. Its use is recommended to control the operation of air-circulating or booster fans. This instrument operates the fan economically and prevents blowing cold air into the room if furnace is not hot enough to deliver heat.

All Type M-53SW Controls are furnished standard with lock type manual switch button. Turning button locks fan switch in "on" position and permits operation of fan during summer months for ventilating purposes. When furnace is again fired and temperature rises, manual switch automatically unlatches and restores control to normal operation.

The Mercoid switch is of the enclosed mercury contact type. It is not subject to open arcing, corrosion, oxidation, or pitting and will operate indefinitely without deterioration. The mechanism of this control has many outstanding features. The dial, located in the center of the instrument, slowly rotates as the temperature on the bi-metal coil increases or decreases. This dial is clearly calibrated in degrees Fahrenheit, and a pointer indicates the temperature in the furnace or duct,—enabling the installation or service men to check the fan operation.

A simple double adjustment is provided for setting both the "high" and "low" operating points. The range can be adjusted over the entire scale, and the differential can be set for very close operation, or may be widened to meet any field requirements.

The flange provided permits mounting of this control on any furnace hood, as it is adjustable for any angle between 30 and 90 degrees. Easily installed by means of the four sheet metal screws provided.

SPECIFICATIONS

TYPE M-53SW: Standard ranges 25 to 300°F., or 50 to 500°F. Circuit closes as temperature rises. Recommended for installations where minimum temperature codes are not in effect.

TYPE M-53SWD: Recommended where local code requirements or The National Board of Fire Prevention specifications are enforced. Range adjustable 25 to 175°F. Circuit closes as temperature rises.

TYPE M-53SWG: Complies with A.G.A. ruling limiting the operating temperatures of warm air fans. Range adjustable 25 to 200°F. Single pole—circuit closes on rise in temperature.

ELECTRICAL CAPACITY: Standard single pole instruments, 10 amp. 115V., 5 amp. 230V. either A.C. or D.C. Not available for 440V.

MOTOR RATING: 1-H.P. Repulsion-Induction, ½ H.P. Split Phase or D.C.

SPECIAL CIRCUITS: Available double pole or two circuit—see page 56 for ordering data and addition to list price.

TYPE NO.	RANGE ADJ.	CODE	LIST PRICE
M-53SW	25-300° F.	utowe	$7.50
M-53SW	50-500° F.	utoxf	7.50
M-53SWD	25-175° F.	utoyg	7.50
M-53SWG	25-200° F.	uvokq	7.50

With Centigrade graduations
Code "utin" No extra charge

Shipping weight approx. 5 lbs.

COMBINATION FAN AND LIMIT WARM AIR CONTROLS

EQUIPPED WITH THE MERCOID SEALED MERCURY CONTACT SWITCH

TYPE M-80 COMBINATION FAN AND LIMIT CONTROL —WITH SUMMER SWITCH

Four Adjustments provided for Independently Setting the Cut-in and Cut-out Temperatures of Both the Fan and Limit Switches.


TYPE M-80

The Type M-80 Mercoid Warm Air control is a duplex instrument, combining within one case all of the well known field proven features of the Type M-51 Limit Control and the Type M-53 Fan Control. This instrument is recommended for air conditioning systems or other warm air applications employing forced circulation and automatic heating equipment. The limit switch opens its circuit on rising temperatures and protects the furnace against overheating. The fan switch, which closes its circuit on rising temperatures, regulates the operation of the fan and prevents blowing cold air into the rooms if the furnace is not hot enough to deliver heat.

The mechanism of this control has many outstanding features. A red dial, located in the center of the instrument, slowly rotates as the temperature changes on the bimetal coil. This dial is clearly calibrated in Fahrenheit degrees with a scale in duplicate—one scale for the limit switch settings, the other for the fan switch settings. A temperature indicating pointer is provided which indicates, on the graduated dial, the temperature in the furnace or duct. Serving the same purpose as a thermometer this temperature indicator enables installation or service men to check the proper size of fire when making necessary adjustments.

Four simple adjustments are provided for independently setting the cut-in and cut-out temperatures of both the fan and limit switches. The differentials can be set for very close operation or can be widened to meet any field requirement.

The Mercoid enclosed mercury contact switches are not subject to open arcing, corrosion, oxidation or pitting and operate indefinitely without deterioration.

This instrument is provided as standard with a special adjustable flange which permits mounting on any furnace hood, where the angle is from 30 to 90 degrees. Easily installed by means of four sheet metal screws provided. For air conditioning units with flat surfaces, can be furnished on special order with flat non-adjustable flange as illustrated at reduced cost when ordered in quantities—Prices on application.


SIDE VIEW TYPE M-80 SHOWING ADJUSTABLE FLANGE

ALL TYPES STANDARD WITH SUMMER SWITCH

All Combination Controls are furnished standard with lock type manual switch button. Turning button locks fan switch in "on" position and permits operation of fan during summer months for ventilating purposes. When furnace is again fired and temperature rises manual switch automatically unlatches and restores control to normal operation.

LINE VOLTAGE INSTRUMENTS

The following instruments are for general applications where the limit switch and fan switch are required to directly control motors at line voltage.

TYPE M-80—For general applications. Range adjustable from 50 to 300° F.

TYPE M-82—For general applications requiring very close differentials. This instrument is equipped with longer bi-metal operating coil for more sensitive operation. Range adjustable from 50 to 225° F.

TYPE M-84—Complies with Detroit ordinance limiting operating temperatures of warm-air furnaces. Fan switch range 50 to 175°, Limit switch 50 to 200° F.

TYPE M-88—Complies with A.G.A. ruling limiting operating temperatures of warm air furnaces. Fan switch range 50 to 200°, Limit switch 50 to 250° F.


STRAIGHT NON-ADJUSTABLE MOUNTING FLANGE

LINE VOLTAGE FAN SWITCH—LOW VOLTAGE LIMIT SWITCH

The following instruments are for applications where the fan is to be directly controlled at line voltage and where the limit switch is to control low voltage equipment such as gas valves, damper controls etc. As both line voltage and low voltage enter the same case a steel barrier with low voltage cable clamp is provided between the terminal posts in accordance with requirements of Underwriter's Laboratories, Inc.

TYPE M-80B—Same as Type M-80 except with barrier. **TYPE M-82B**—Same as Type M-82 except with barrier. **TYPE M-84B**—Same as Type M-84 except with barrier. **TYPE M-88B**—Same as Type M-88 except with barrier.

ELECTRICAL CAPACITY (Each Circuit): 10 amp.-115 Volt, 5 amp.-230 Volt, A.C. or D.C.

MOTOR RATING (Each Circuit): 1 H.P. Repulsion-Induction, ½ H.P. Split-Phase or D.C.

LINE VOLTAGE CONTROLS

TYPE NO	RANGE ADJ	CODE	LIST PRICE
M-80	50 to 300°	uvfuh	$11.00
M-82	50 to 225°	uvfvi	12.00
M-84	Fan 50 to 175° Limit 50 to 200°	uvfyl	12.00
M-88	Fan 50 to 200° Limit 50 to 250°	uvogm	12.00

LINE VOLTAGE—LOW VOLTAGE

TYPE NO	RANGE ADJ	CODE	LIST PRICE
M-80B	50 to 300°	uvfzm	$11.00
M-82B	50 to 225°	uvgac	12.00
M-84B	Fan 50 to 175° Limit 50 to 200°	uvgbd	12.00
M-88B	Fan 50 to 200° Limit 50 to 250°	uvohn	12.00

Furnished standard with adjustable mounting flange. Can be furnished to manufacturers on special order with non-adjustable flat flange at reduced cost when ordered in quantities—Prices on application.

Shipping weight approx. 6 lbs.

TYPE M-80F COMBINATION FAN AND LIMIT CONTROL

WITH FLANGED CASE—FOR DIRECT ATTACHMENT TO FURNACE JACKETS


TYPE M-80F

Type M-80F Mercoid Combination Fan and Limit Controls incorporate the summer switch as well as all of the desirable adjustment features of the Type M-80 listed above. They are, however, supplied with flanged case for direct attachment to furnace jackets. Type M-80F controls are especially recommended for use in connection with furnace burner units which have a flat vertical surface. The appearance of the furnace is greatly improved by the flange mounting, and all wiring is concealed behind the furnace jacket.

STANDARD FINISH: Hard, rubber black enamel.

SPECIAL FINISHES: To manufacturers requiring quantities the Type M-80F can be furnished with special finish to match furnace jacket .... Prices on application.

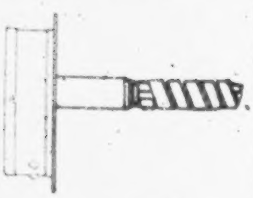
STANDARD SLEEVE LENGTH: Standard stock instruments have an overall length, from the back of the instrument case to the end of the bimetal coil, as follows: Types M-80F and M-80BF—7 inches; Types M-84F and M-84BF—6 inches. Available to manufacturers in quantities with special sleeve lengths as desired ..... Prices on application.

LINE VOLTAGE INSTRUMENTS

The following instruments are for general applications where the limit switch and fan switch are required to directly control motors at line voltage.

TYPE M-80F—For general applications. Range adjustable from 50 to 300°F.

TYPE M-84F—Complies with A.G.A. ruling as well as Detroit ordinance limiting the operating temperatures of warm air furnaces. Equipped with long sensitive bi-metal coil, but stop pins are provided which limit Fan Switch adjustments to 175° F. and Limit Switch adjustments to 200° F.


SIDE VIEW TYPE M-80F

LINE VOLTAGE FAN SWITCH—LOW VOLTAGE LIMIT SWITCH

The following instruments are for applications where the fan is to be directly controlled at line voltage and where the limit switch is to control low voltage equipment such as gas valves, damper controls etc. As both line voltage and low voltage enter the same case a steel barrier with low voltage cable clamp is provided between the terminal posts in accordance with requirements of Underwriter's Laboratories, Inc.

TYPE M-80BF—Same as Type M-80F except with barrier. Range 50 to 300°F.

TYPE M-84BF—Same as Type M-84F except with barrier. Fan switch range 50 to 175°. Limit switch 50 to 200°F.

ELECTRICAL CAPACITY AND MOTOR RATING same as Type M-80 shown above.

LINE VOLTAGE CONTROLS

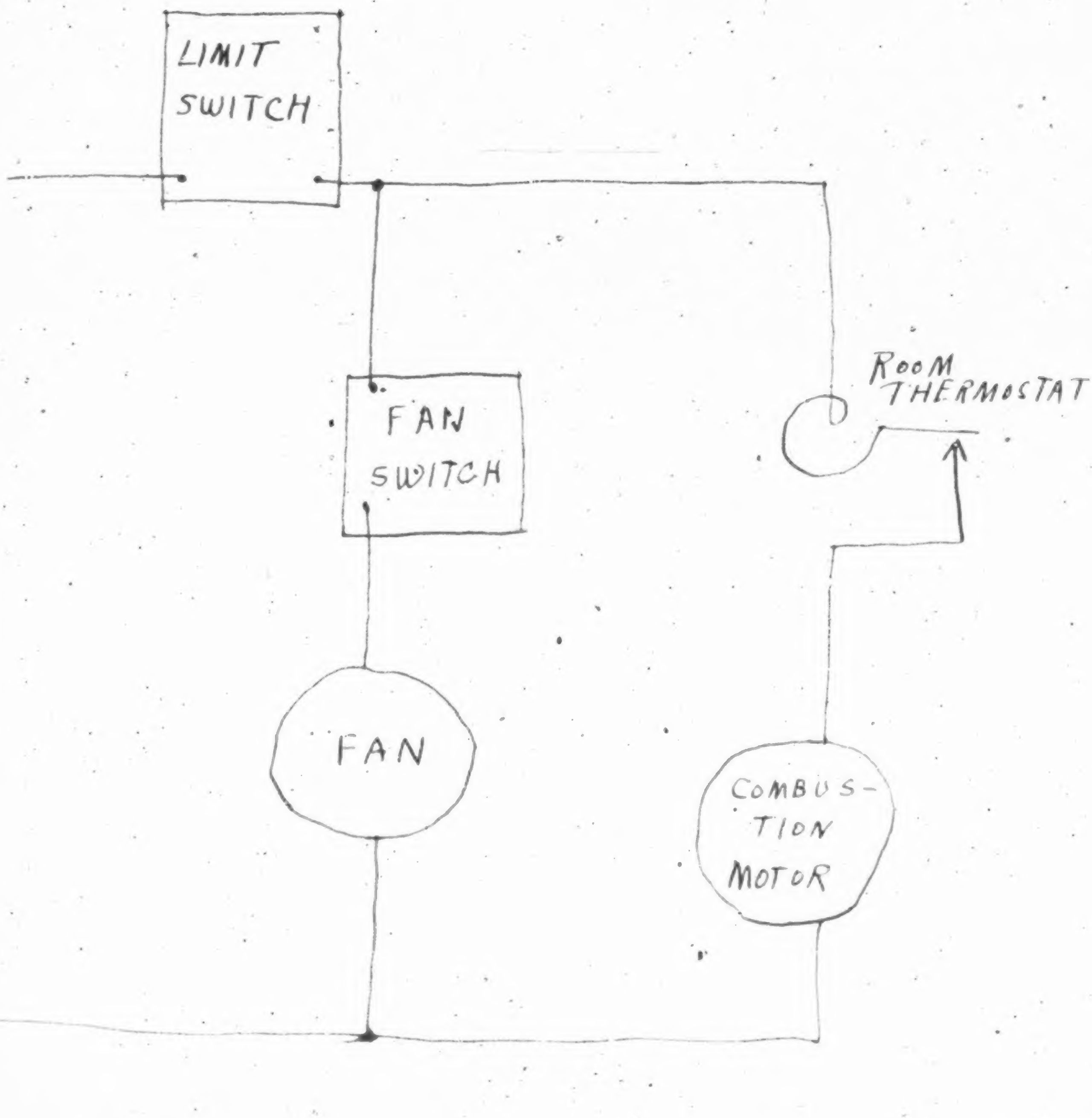
TYPE NO	RANGE ADJ	CODE	LIST PRICE
M-80F	50 to 300°	uvgce	$10.25
M-84F	Fan 50 to 175° Limit 50 to 200°	uvgeg	11.25

LINE VOLTAGE—LOW VOLTAGE

TYPE NO	RANGE ADJ	CODE	LIST PRICE
M-80BF	50 to 300°	uvggi	$10.25
M-84BF	Fan 50 to 175° Limit 50 to 200°	[illegible]	11.25

NOTE: Special net prices quoted manufacturers requiring quantities.

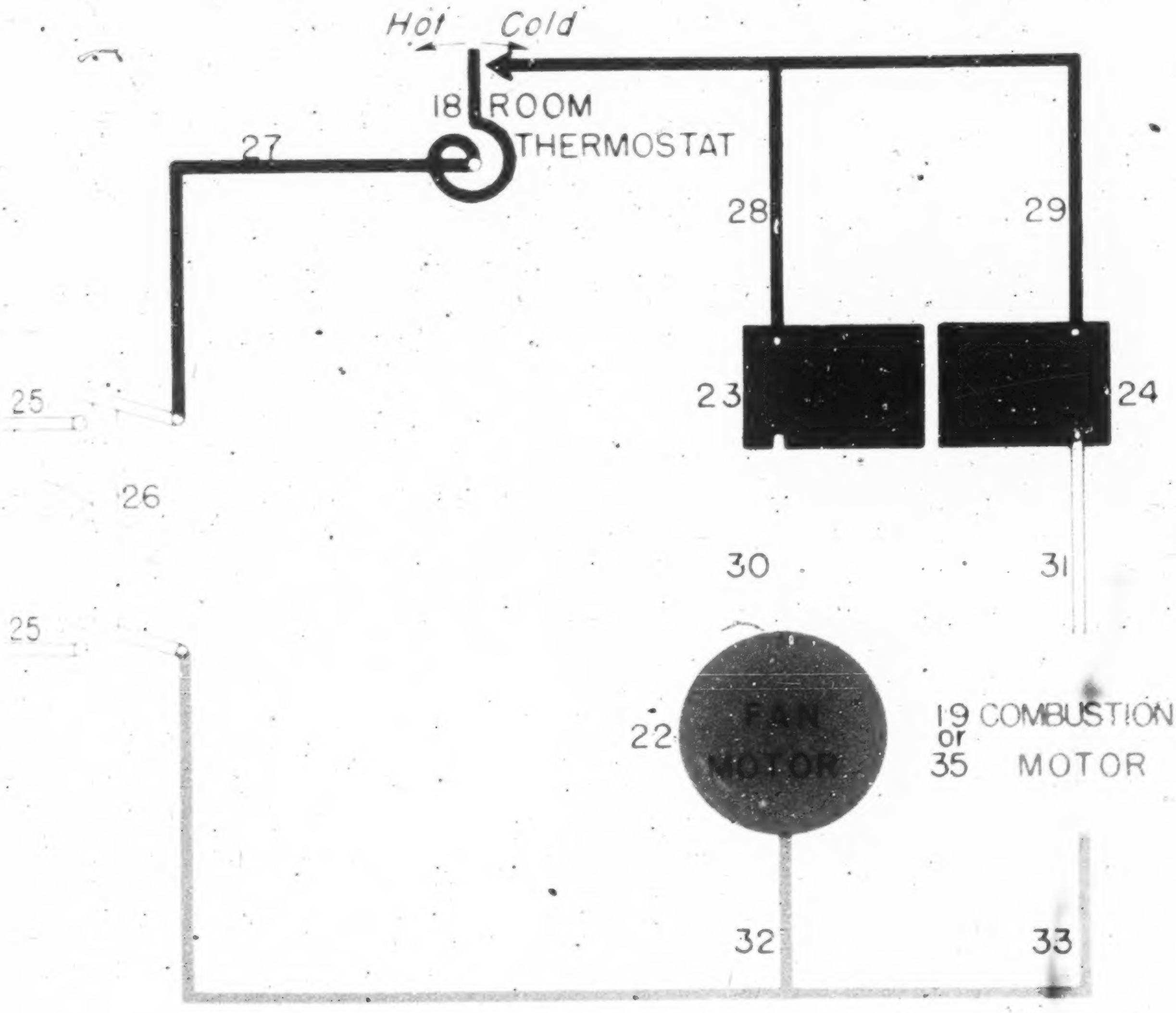
Shipping weight approx. 6 lbs.


LIMIT SWITCH
FAN SWITCH
ROOM THERMOSTAT
FAN
COMBUS-TION MOTOR

M-H Ex. 12

FREEMAN PATENT

OPERATION SEQUENCE DRAWING



DRAWING ILLUSTRATING SEQUENCE OF OPERATION OF FREEMAN FURNACE CONTROL PERMITTING CHECKING OF COMBUSTION BY LIMIT SWITCH WHILE FAN CONTINUES TO OPERATE ON HIGH FURNACE TEMPERATURE

M-H EXHIBIT 13

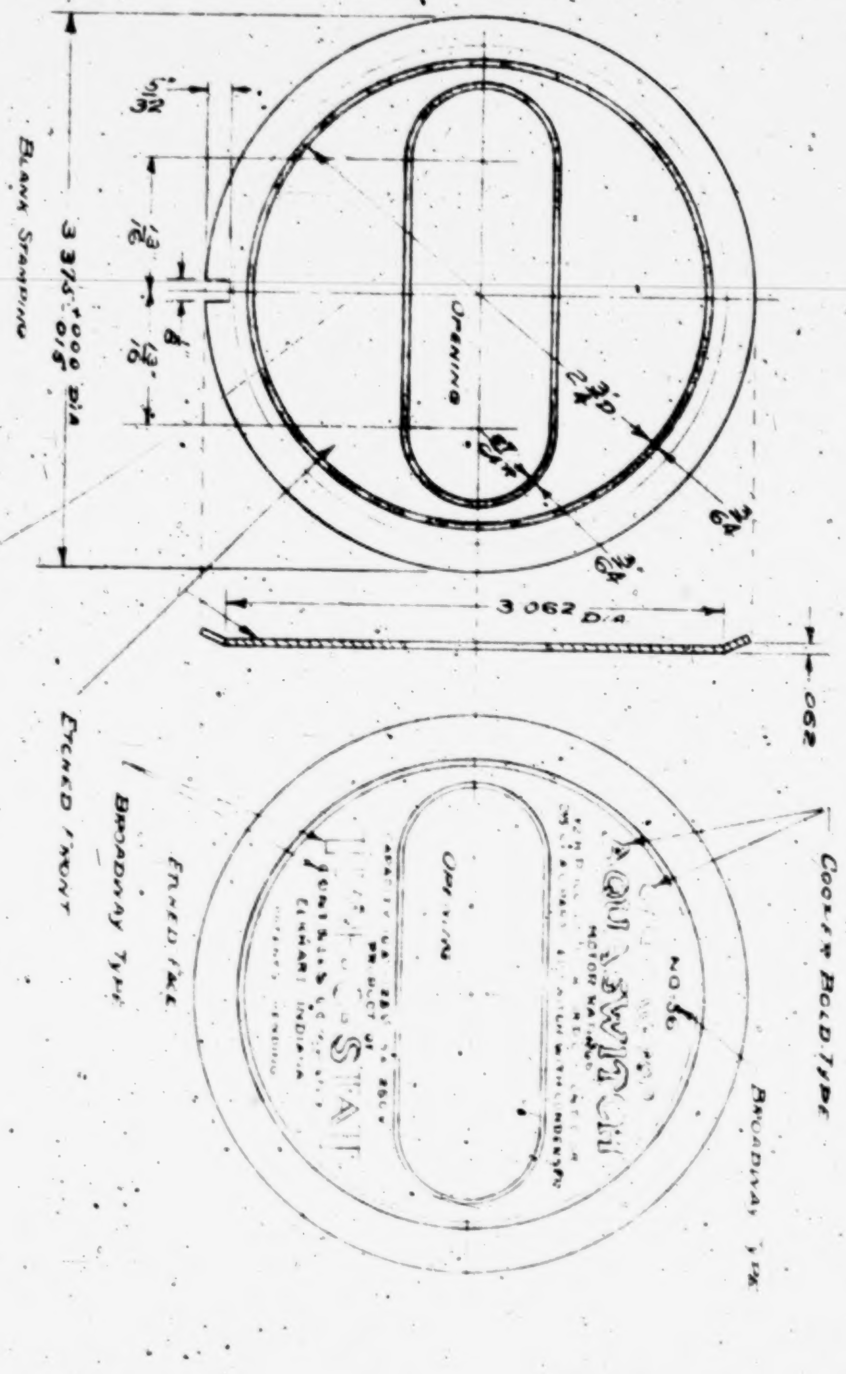
CHANGE ISSUE	PURCHASE MATERIAL SPEC.	FINISH	ABSOLUTE CON-TAC-TOR CORP. ELKHART, IND., U.S.A.	N-350
3-29-29 Thickness was .062 Gauge " 19 B&S	SHEET ALUM	STOCK PER C —	NAME: NAME PLATE	
STOCK SIZE	GAUGE 18 B&S	TEMPER —	FEET PER C —	
THICKNESS .040"	WIDTH —	LENGTH —	LBS. PER C —	DR. CMC. CHK. APPD. DATE 3-11-29
				SCALE 12" = 1 FT. SUPER N-223 DATE 9-2-27

MANUFACTURING SPEC. DO NOT SCALE DRAWING

A TOLERANCE OF ±.005 IS ALLOWED ON FRACTIONAL DIMS AND ±.002 ON DEC. DIMS. UNLESS OTHERWISE SPECIFIED

FINISH SEE NOTE

LIST	REQ
56	1



NOTE

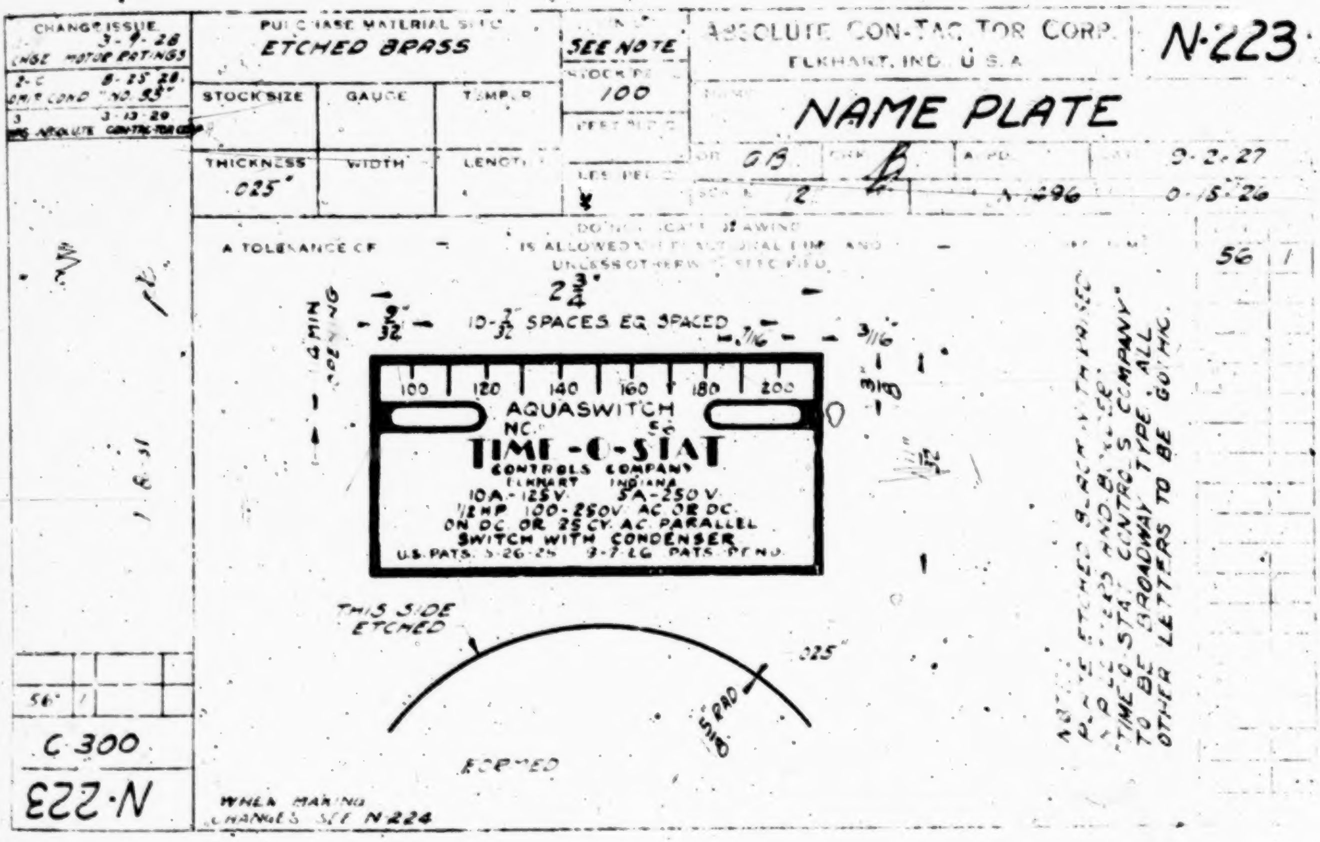
THE WORD "ROLASWITCH" IN RED WITH ALUM OUTLINE OTHER LETTERING AND BORDER RAISED POLISHED ALUM WITH BLACK BACKGROUND LETTERING NOT SPECIFIED TO BE IN GOTHIC TYPE

N-350

N-341	N-906
WHEN MAKING CHANGES SEE	

N-350

"H" Exhibit 26

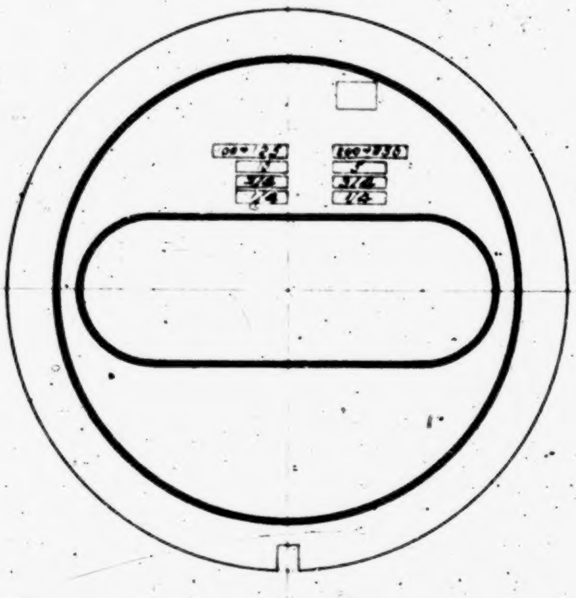


M-H. Exhibit 28

CHANGE ISSUE	PURCHASE MATERIAL SPEC			FINISH	TIME-O-STAT CONTROLS CO. ELKHART, IND., U.S.A.			N-350
1404745-11-19-31 3/4 WAS 1/2 1/4 WAS 1/6	STOCK SIZE	GAUGE	TEMPER	STOCK PER C 100	NAME NAME PLATE			
				FEET PER C				
	THICKNESS	WIDTH	LENGTH	LBS. PER C	DR A.H.L.	CHK	APPD	DATE 3-3-31.
					SCALE 1/2	SUPER N-350		DATE 3-11-29

MANUFACTURING SPEC DO NOT SCALE DRAWING
A TOLERANCE OF IS ALLOWED ON FRACTIONAL DIMS AND ON DEC. DIMS
FINISH— UNLESS OTHERWISE SPECIFIED

LIST	REQ
56	1



NOTE:-
MAKE FROM N-974
ON SMALL ORDERS STAMP AS SHOWN
ON LARGE ORDERS ETCH IN BLACK
ON ALUM PADS

OBSOLETE
DATE 4-9-40
BY My E.O. 9004

N-974
WHEN MAKING CHANGES SEE

N-350

M-H. Exhibit 29

PEASE, CHICAGO

(M-H Ex. 30)

RECEIVED

APR 1 1939

ESTABLISHED 1885

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

M-H AUTOMATIC CONTROL SYSTEMS · BROWN INDUSTRIAL INSTRUMENTS · NATIONAL PNEUMATIC CONTROLS

MINNEAPOLIS, MINN.

April 18, 1939.

Perfex Corporation,
415 West Oklahoma Place,
Milwaukee, Wisconsin.

Gentlemen:

In connection with our license agreement to you under the Freeman Patent No. 1,813,732, we agree that so long as you do not sell separate heating medium temperature responsive controls for carrying out the system of the Freeman patent at a combined price which is less than 25¢ higher than the prices set forth in the Price Schedule of the agreement for any specific "Combination Furnace Control" comparable to carrying out in operation and function what the separate controls would do, we will not assert our rights against you or your customers under the Freeman Patent on account of such sales.

Yours very truly,

W. L. Huff

W. L. Huff - Vice President
& Treasurer.

WLF:med

FACTORIES LOCATED IN MINNEAPOLIS, MINN., PHILADELPHIA, PA., CHICAGO, ILL., WABASH, IND., AND TORONTO, ONTARIO, CANADA · BRANCH AND DISTRIBUTING OFFICES IN ALL PRINCIPAL CITIES

M-H Exhibit 31

M H Exhibit 31

September 5, 1940

Minneapolis-Honeywell Regulator Company
Minneapolis
Minnesota

Re: Freeman License under
Patent 1,813,732

Attention: Mr. George H. Fisher, Attorney

Dear George:

We have just noticed that in the letter from you dated August 20, 1940, which was signed by Mr. W. L. Huff, there is a difference from the same letter dated April 18, 1939, which difference apparently resulted from a typographical error. In the letter dated April 18, 1939 - you will note that the phrase twenty-five cents was written as "25¢" - whereas in the letter dated August 20, 1940 this is written as "25%" (twenty-five percent).

Will you please verify this?

Very truly yours
PERFEX CORPORATION

VRTate/bls

Secretary

M-H Exhibit 31

ESTABLISHED 1885

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

M-H AUTOMATIC CONTROL SYSTEMS · BROWN INDUSTRIAL INSTRUMENTS · M-H (NATIONAL) PNEUMATIC CONTROLS

MINNEAPOLIS, MINN.

August 20, 1940

Perfex Corporation,
415 W. Oklahoma Place,
Milwaukee, Wisconsin.

Gentlemen:

In connection with our license agreement to you under the Freeman Patent No. 1,813,732, we agree that so long as you do not sell separate heating medium temperature responsive controls for carrying out the system of the Freeman patent at a combined price which is less than 25¢ higher than the prices set forth in the Price Schedule of the agreement for any specific "Combination Furnace Control" comparable to carrying out in operation and function what the separate controls would do, we will not assert our rights against you or your customers under the Freeman Patent on account of such sales.

Yours very truly,

W. L. Huff

W. L. Huff - Vice President

WLF:med

FACTORIES: MINNEAPOLIS, MINN., PHILADELPHIA, PA., CHICAGO, ILL., WABASH, IND., TORONTO, ONTARIO CANADA, LONDON, ENGLAND
BRANCH AND DISTRIBUTING OFFICES IN ALL PRINCIPAL CITIES IN THE UNITED STATES AND FOREIGN COUNTRIES

M-H Exhibit 31

ESTABLISHED 1885

AUTOMATIC CONTROLS MH

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

M-H AUTOMATIC CONTROL SYSTEMS · BROWN INDUSTRIAL INSTRUMENTS · M-H (NATIONAL) PNEUMATIC CONTROLS

PATENT DEPARTMENT
G. H. FISHER, ATTORNEY

September 6, 1940

Perfex Corporation
415 W. Oklahoma Place
Milwaukee, Wisconsin

Attention: V. R. Tate, Secretary

Dear Bob:

Thanks very much for your letter of September 5, 1940. I am glad that you noticed this typographical error.

I am attaching hereto the original and one extra copy of a new letter dated August 20th to replace the incorrect one sent you heretofore. Will you please return the incorrect letter.

Yours very truly,

George H Fisher

George H. Fisher, Attorney

GHF:VS
Enclos.

RECEIVED
SEP 9 1940
PAT. DEPT.

RECEIVED
SEP 9 1940

FACTORIES MINNEAPOLIS MINN PHILADELPHIA PA CHICAGO ILL WABASH IND TORONTO ONTARIO CANADA LONDON ENGLAND
BRANCH AND DISTRIBUTING OFFICES IN ALL PRINCIPAL CITIES IN THE UNITED STATES AND FOREIGN COUNTRIES

1509 And afterwards, to wit, on the 27th day of February, A. D. 1942, being one of the days of the regular February term of said Court, in the record of proceedings thereof, in said entitled cause, before the Honorable John P. Barnes, District Judge, appears the following entry, to wit: Entered Feb. 27, 1942

1510 IN THE DISTRICT COURT OF THE UNITED STATES.

* * (Caption—1839) * *

MEMORANDUM.

On June 29, 1940, The Mercoid Corporation, a corporation of Delaware, having a principal place of business and factory in the city of Chicago, Illinois, (hereinafter referred to as "Mercoid"), filed its complaint for a declaratory decree against Minneapolis-Honeywell Regulator Company, a corporation of Delaware, licensed to do business in the state of Illinois (hereinafter referred to as "Minneapolis-Honeywell"). Subsequently, Mercoid filed its supplemental complaint against Minneapolis-Honeywell. By its complaint and supplemental complaint, Mercoid sought a decree adjudging that its devices, known as fan and limit controls, do not infringe or contribute to the infringement of Minneapolis-Honeywell's Freeman Patent No. 1,813,732, adjudging that said patent is invalid, and adjudging that Minneapolis-Honeywell has granted licenses to others to set up a monopoly beyond the scope of said patent, in restraint of trade and in violation of the antitrust laws of the United States.

By its answer, Minneapolis-Honeywell alleged that the Mercoid fan and limits control is so constructed and arranged as to carry out the teachings and invention of Freeman Patent No. 1,813,732, that said device infringes said patent, and that said patent is valid, and it admits that it has granted licenses under said patent to certain named licensees, but it denies that it has granted licenses which broaden or tend to broaden the scope of said patent.

1511 On July 1, 1940, Minneapolis-Honeywell filed a complaint against Mercoid, wherein it charged infringement by Mercoid of said Freeman Patent No. 1,813,732. Mercoid answered, and by its answer denied infringement, denied validity of the patent, alleged that Minneapolis-Honeywell has been guilty of laches and is utilizing said

patent to establish a monopoly in the sale of a combination furnace control *per se* not coming within the boundaries of the Freeman patent.

The cases were consolidated and tried together.

Freeman Patent No. 1,813,732 was issued July 7, 1931, on an application filed January 16, 1931. In this patent, it is said:

"This invention relates to control apparatus, principally for use with a hot air furnace.

"The principal object of the invention is to provide a control for the rate of combustion and for the operation of an accelerating device, such as a fan, blower or similar apparatus, used for accelerating the rate of supply of the heat-conducting medium, such as air, to be heated by the furnace, said control being such as to permit the operation of said accelerating device and to check combustion in case the furnace becomes overheated and such as to interrupt the operation of said accelerating device while increasing the rate of combustion if the furnace has not been heated above a predetermined temperature.

"In addition, a control feature is added by means of which both the combustion and the supply of the heat-conducting medium are checked when the temperature of the room or object to be heated is above a predetermined degree."

As applied to a hot air furnace fired by a coal stoker, the system disclosed by the patent includes three thermostats, one in the room or space to be heated operated by changes in the temperature in said room or space and two in the hood of the furnace operated by changes in the temperature of the air in said hood. One of these last mentioned thermostats opens and closes a circuit passing through the motor which drives the coal stoker, and the other thermostat in the hood opens and closes the circuit which passes through the motor which drives a fan in the cold air supply to the furnace.

The patent contains ten claims. Claims 1, 2, 3, 6, 7, and 8 omit reference to the room thermostat. Claims 4, 5, 9 and 10 include references to three thermostats. Minneapolis-Honeywell relies upon Claims 1, 4, 6 and 9. They are as follows:

1512 1. In a furnace control, the combination of apparatus for controlling the rate of combustion and the rate of supply of a heat-conducting medium, thermostatic apparatus responsive to furnace temperature, and connec-

tions between said control apparatus and said thermostatic apparatus by means of which said control apparatus operates to check combustion while supplying said medium when furnace temperature exceeds a predetermined degree.

4. In a furnace control, the combination of apparatus for controlling the rate of combustion and the rate of supply of a heat-conducting medium, thermostatic apparatus responsive to furnace temperature, connections between said control apparatus and said thermostatic apparatus by means of which said control apparatus operates to check combustion while supplying said medium when furnace temperature exceeds a predetermined degree, other thermostatic apparatus responsive to the temperature of the object to be heated, and connections between said control apparatus and said last-mentioned thermostatic apparatus by means of which said control apparatus operates to check both combustion and the supply of said medium when said object is above a predetermined temperature irrespective of the furnace temperature.

6. In a furnace control, the combination of an electrically-operated combustion control apparatus adapted to accelerate combustion when supplied with electric power and to check combustion when not so supplied, a motor-driven fan for controlling the supply of air to be heated, a source of electric power, electric circuits for connecting said power source to said control apparatus and the motor of said fan, and thermostatic apparatus interposed in said circuits, responsive to furnace temperature and adapted to interrupt the circuit to said combustion control apparatus while completing the circuit to the motor of said fan when furnace temperature is above a predetermined degree.

9. In a furnace control, the combination of an electrically-operated combustion control apparatus adapted to accelerate combustion when supplied with electric power and to check combustion when not so supplied, a motor-driven fan for controlling the supply of air to be heated, a source of electric power, electric circuits for connecting said power source to said control apparatus and the motor of said fan, thermostatic apparatus interposed in said circuits, responsive to furnace temperature and adapted to interrupt the circuit to said combustion control apparatus while completing the circuit to the motor of said fan when furnace temperature is above a predetermined degree, and other thermostatic apparatus interposed in said circuits in series

connection with said first-mentioned thermostatic apparatus, responsive to the temperature of the space to be heated and adapted to interrupt the circuits to both said combustion control apparatus and to the motor of said fan when said last mentioned temperature is above a predetermined value.

1513 As against the validity of the Freeman patent, Mercoid cites Teal Patent No. 1,067,627. The Teal patent discloses no fan or thermostat in the furnace hood controlling a fan. In this respect it is like Johnson Patent No. 1,602,363, Mercoid Bulletin D of April 1, 1924, Mercoid Catalog H-3 of 1928, page 28, and Oil-O-Matic Drawing A-150 of December 24, 1925, which were also cited by Mercoid. Mercoid also cited Wiring Diagram No. 740, on page 31 of its catalog No. G-5 of 1929 revised edition. This disclosed the same sort of a control as Teal. Mercoid also cited Edgecombe Reissue Patent No. 15,531. Edgecombe differs from Freeman in that it has two room thermostats instead of a one room thermostat, and has no limit switch in the furnace hood. Mercoid also cited Cross Patent No. 1,758,146. Cross differs from Freeman in that it has neither a fan thermostat nor a limit thermostat in the furnace hood. Mercoid also cited Illustration No. 4 in its Bulletin A-5 of June, 1930. Illustration No. 4 merely discloses a portion of the disclosure of the Edgecombe Patent. Specifically, there is no disclosure of a limit switch or a combustion motor. Mercoid also cited Mercoid Drawing No. 266 of September 27, 1927. This disclosure differs from that of Freeman in that in Drawing No. 266 the limit switch is cut into the circuit ahead of the room thermostat, which, of course, makes an entirely different sequence of operation. Mercoid also cited Drawing No. 748 in its Catalog No. H-5 of 1929, Revised Edition. Drawing No. 748 also sets the limit switch ahead of the room thermostat, thereby making a sequence of operation entirely different from that of Freeman. Neither Mercoid Drawing No. 266 of September 27, 1927, nor Drawing No. 748 of Mercoid Catalog No. H-5 of 1929 shows a limit switch between the room thermostat and the combustion motor, as does Freeman.

1514 Mercoid also set up several prior uses—that of Portner at Wheaton, Illinois, and those of the Evangelical Church and Ned Dolan at Bloomington, Illinois. It is clear that Portner is now using a system of furnace control which closely approaches that of the patent in suit,

though it is a fact that it differs in one particular. The Court is not satisfied, however, that it was installed as it now exists prior to the Freeman date of application. The same thing is true of the Evangelical Church and Ned Dolan prior uses. They differ somewhat from Freeman disclosure in at least one particular, but their great defect is that the court is not satisfied that they were installed in their present condition prior to the Freeman critical date.

The court is of the opinion that the Freeman patent discloses invention over the prior art and that it is valid.

Referring to the defense of laches, the court is of the opinion that there are no elements of estoppel involved and that the mere delay which has taken place does not contribute a defense.

On the charge that Minneapolis-Honeywell has been using its patent on the Freeman system of furnace control as a means of creating or attempting to create a monopoly on an unpatented device, contrary to the rule laid down in the Morton Salt Case and those somewhat similar cases which preceded but perhaps do not go quite as far as the Morton Salt Case, the court is of the opinion that it must be held that Minneapolis-Honeywell has been so using its patent as to tend to create a monopoly in an unpatented device. Minneapolis-Honeywell has been licensing others and has offered to license Mercoid to manufacture, use and sell a single device which embodies within itself two elements of the Freeman patent, namely, the two thermostats which are placed in the furnace hood, one being the
1515 fan switch and the other being the limit switch. This device, embodying these two elements, is said to be a patented device, but the patent is owned by some person other than Minneapolis-Honeywell and Mercoid, so as to them and so far as this case is concerned it is an unpatented device. The Freeman patent is not a patent on either the fan switch or the limit switch or both of them. It is a patent on a system of furnace control, which requires three thermostats for its operation. It happens that two of those thermostats are a fan switch and a limit switch.

The court is of the opinion that it follows, from what has been said, that both complaints, that of Mercoid and that of Minneapolis-Honeywell, must be dismissed for want of equity.

The court is of the opinion that it will be equitable to divide the costs, and that shall be done.

Counsel for each side may prepare and, within 7 days from this date, present drafts of findings of fact, conclusions of law, and a decree not inconsistent with the views hereinabove expressed. Counsel may, within 14 days from this date, present, in writing, such, if any, observations in respect of or exceptions to the drafts presented on behalf of the other side as he may deem necessary or desirable. This having been done, the matter of making findings of fact, conclusions of law, and a decree will be taken by the court without further oral argument.

Counsel may take and keep, subject to the order of the court, the exhibits of their respective clients.

Barnes,
Judge.

February 27, 1942.

1516 And afterwards, to wit, on the 24th day of March, A. D. 1942, being one of the days of the regular March term of said Court, in the record of proceedings thereof, in said entitled cause, before Honorable John P. Barnes, District Judge, appears the following entry, to wit: Filed March 24, 1942

1517 IN THE DISTRICT COURT OF THE UNITED STATES,

For the Northern District of Illinois,

Eastern Division.

The Mercoid Corporation, *Plaintiff*, *vs.* Minneapolis-Honeywell Regulator Company, *Defendant*.	Civil Action No. 1839.
	Consolidated Case No. 1839.
Minneapolis-Honeywell Regulator Company, *Plaintiff*, *vs.* The Mercoid Corporation, *Defendant*.	Civil Action No. 1842.

FINDINGS OF FACT AND CONCLUSIONS OF LAW.

This Cause having been heard in open court, where all the parties were represented by counsel, presented evidence, and made argument, the Court makes the following Findings of Fact and Conclusions of Law:

Findings of Fact.

1. The Mercoid Corporation, (hereinafter called "Mercoid"), is a corporation organized under the Laws of the State of Delaware, having a principal place of business and factory in the City of Chicago, Illinois.

1518 2. Minneapolis-Honeywell Regulator Company (hereinafter called "Minneapolis-Honeywell"), is a corporation organized under the Laws of the State of Delaware, and is licensed to do business in the State of Illinois.

3. Minneapolis-Honeywell is the sole owner of United

States Letters Patent No. 1,813,732, issued July 7, 1931, to Edward E. Freeman, on an application filed January 16, 1931, entitled "Furnace Control."

4. On June 29, 1940, Mercoid filed its complaint for a declaratory decree against Minneapolis-Honeywell, and later filed a supplemental complaint. Mercoid, by its complaint and supplemental complaint, asks for a decree holding that its devices, known as fan and limit controls, do not infringe or contribute to the infringement of said Freeman patent No. 1,813,732, and that said patent is invalid, and Minneapolis-Honeywell, in granting licenses to others, has set up a monopoly beyond the scope of said patent, in violation of the anti-trust laws of the United States.

5. On July 1, 1940, Minneapolis-Honeywell filed a complaint against Mercoid charging infringement and contributory infringement by Mercoid of said Freeman patent No. 1,813,732. Mercoid, in its answer, denied infringement and contributory infringement, denied validity of the patent, and alleged that Minneapolis-Honeywell was guilty of laches.

1519 6. The suit brought by Mercoid and the suit brought by Minneapolis-Honeywell were consolidated and tried together.

7. The accused Mercoid device is exemplified by Mercoid's Physical Exhibit PPP, which device is known as Type M-80.

8. Mercoid's wiring diagrams for installation of the accused Mercoid device as a furnace control, are illustrated in Mercoid's bulletin M-12, Mercoid's Exhibit CC, and installation of the accused device in accordance with said wiring diagrams results in the sequence of operation of the Freeman invention.

9. Minneapolis-Honeywell relies for infringement and contributory infringement upon claims 1, 4, 6 and 9 of said Freeman patent No. 1,813,732 (Civil Action No. 1842).

10. The control apparatus disclosed in the Freeman patent is directed to a hot air furnace and includes three thermostats, one in the room or space to be heated, operated by changes in temperature in the room or space to be heated, and, two in the hood of the furnace operated by changes in the temperature of the air in the hood of the furnace. Of the two thermostats in the hood of the furnace, one opens and closes a circuit to the combustion motor and the other thermostat opens and closes a circuit through a motor for driving a fan located in the cold air

supply of the furnace for delivering the heating medium from the furnace to the room or space to be heated.

11. As to the claims relied on by Minneapolis-Honeywell, claims 1 and 6 do not specify a room thermostat, whereas claims 4 and 9 do include a room thermostat.

1520 12. As to the ten claims in the patent, claims 1, 2, 3, 6, 7 and 8 do not specify a room thermostat, whereas claims 4, 5, 9 and 10 do include a room thermostat.

13. The prior art, prior invention and prior public uses relied upon by Mercoid as against the validity of the Freeman patent No. 1,813,732, are as follows:

Patents

Teal	No. 1,067,627	Johnson	1,602,363
Edgecombe	No. Re. 15,531	Cross	1,758,146

Publications and Wiring Diagrams

Mercoid Bulletin D, April 1, 1924.
Mercoid Catalog H-3, of 1928, page 28.
Oil-O-Matic drawing A-150, of Dec. 24, 1925.
Mercoid wiring diagram 740, page 31, of Mercoid Catalog H-5, 1929.
Illustration No. 4, Mercoid Bulletin A-5 of June, 1930.
Mercoid drawing 266, dated Sept. 27, 1927.
Mercoid drawing 748 of Catalog H-5 of 1929.

Prior Uses.

J. A. Portner, place of business, Wheaton, Illinois,
Evangelical Church, Bloomington, Illinois, and
Ned Dolan residence, Bloomington, Illinois.

14. The Court finds that the Teal patent discloses no fan for delivering the heating medium from the furnace to the room or space to be heated and no thermostat in the furnace hood for controlling a fan.

Johnson patent 1,602,363; Mercoid's Bulletin D, dated April 1, 1924; Mercoid's Catalog H-3 of 1928, page 28; Oil-O-Matic drawing No. A-150 dated December 24, 1925, and wiring diagram No. 740 on page 31 of Mercoid Catalog H-5 dated 1929, all follow the Teal patent and lack the disclosure of a fan and a thermostat in the furnace hood for controlling a fan.

1521 15. The Court finds that Edgecombe Reissue Patent No. 15,531 discloses two room thermostats instead

of one, as found in Freeman, and it has no limit switch or thermostat in the furnace hood for opening the circuit passing through the motor which drives the burner upon temperature rise in the furnace hood beyond a safe limit.

Mercoid's illustration No. 4 of Bulletin A-5 dated June 1930 discloses only a portion of the Edgecombe patent and differs from Freeman in that there is no disclosure of a limit switch or a combustion motor.

16. The Court finds that the Cross patent No. 1,758,146 differs from Freeman in that it has neither a fan thermostat nor a limit thermostat in the furnace hood.

17. The Court finds that Mercoid's drawing 266 dated September 27, 1927, differs from Freeman in that the limit switch is cut into the circuit ahead of the room thermostat and this brings about an entirely different sequence of operation.

Drawing No. 748 of Mercoid catalog No. H-5 of 1929 also places the limit switch ahead of the room thermostat, making an entirely different sequence of operation from that of Freeman.

Neither Mercoid drawing No. 266 of September 27, 1927, nor drawing 748 of Mercoid catalog H-5 of 1929 shows a limit switch between the room thermostat and combustion motor, as does Freeman.

1522 18. The Court finds that the several prior uses set up by Mercoid as follows—

J. A. Portner establishment, Wheaton, Illinois,
Evangelical Church, Bloomington, Illinois, and
Ned Dolan residence, Bloomington, Illinois,

closely approach the furnace control of the Freeman patent, although they differ in one particular, have not been proven to the satisfaction of the Court and that these installations relied upon as prior uses were not installed either in the J. A. Portner establishment, or in the Evangelical Church, or in the Ned Dolan residence, in their present condition, prior to the Freeman filing date of January 16, 1931.

19. The Court finds that the Freeman patent discloses invention over the prior patented art, publications and drawings relied upon by Mercoid, and that the patent is valid. (Civil Action No. 1839.)

20. The Court further finds that claims 1, 4, 6 and 9, relied upon by Minneapolis-Honeywell, disclose invention and are valid. (Civil Action No. 1842.)

21. The defense of Mercoid of laches by Minneapolis-Honeywell has not been established since there are no elements of estoppel involved and mere delay does not constitute a defense.

22. The Court finds that when the M-80 is connected as recommended by Mercoid in its illustration No. 8, which forms a part of its installation instructions sent along with each of the M-80 controls, The Mercoid Corporation is a contributory infringer of Claims 1, 4, 6 and 9 of the Freeman patent.

23. The Court finds that Mercoid's Catalog, Ex. CC, contains a wiring diagram substantially like Illustration No. 8.

1523 24. The Court finds that when the M-80 is connected as recommended by Mercoid in its Illustration No. 7, which forms a part of its installation instructions sent along with each of the M-80 controls, The Mercoid Corporation is a contributory infringer of claims 1 and 6 of the Freeman patent.

25. The Court finds that wiring diagrams No. 2403 contained in Mercoid's Bulletin M-H Ex. 10, and another of the wiring diagrams illustrated in Mercoid's Ex. CC, and wiring diagrams 2407, 2408, 2409 and 2410 contained in Mercoid's Booklet M-H, Ex. 11, are all substantially the same as Illustration No. 7 in so far as the use of the M-80 in such wiring diagrams is concerned.

26. Minneapolis-Honeywell has been licensing others and has offered to license Mercoid to manufacture, use and sell a single device which embodies within itself two elements of the Freeman patent, namely, the two thermostats which are placed in the furnace hood, one being the fan switch and the other being the limit switch. This device, embodying these two elements, is said to be a patented device, but the patent is owned by some person other than Minneapolis-Honeywell and Mercoid, so that as to them and so far as this case is concerned, it is an unpatented device.

27. The Freeman patent is not a patent on either the fan switch or the limit switch or both of them. It is a patent on a system of furnace control, which requires three thermostats for its operation.

28. The Court finds that Minneapolis-Honeywell has used its Freeman patent so as to tend to create a monopoly in an unpatented device.

1524 Conclusions of Law.

1. The Court has jurisdiction of the subject-matter and of the parties.

2. Title to the Freeman patent No. 1,813,732 is in Minneapolis-Honeywell.

3. The Freeman patent discloses invention over the prior art, and is valid. (Civil Action No. 1839.)

4. Claims 1, 4, 6 and 9 of the Freeman patent No. 1,813,-732 relied upon by Minneapolis-Honeywell, are valid. (Civil Action No. 1842.)

5. The delay in bringing the suit by Minneapolis-Honeywell against Mercoid does not constitute laches.

6. Minneapolis-Honeywell has used its patent to tend to create a monopoly in an unpatented device.

7. The complaint of Mercoid and the complaint of Minneapolis-Honeywell should be dismissed for want of equity.

Barnes,
United States District Judge.

Chicago, Illinois,
March 24, 1942.

Filed March 24, 1942

1525 And afterwards, to wit, on the 24th day of March, A. D. 1942, being one of the days of the regular term of said Court, in the record of proceedings thereof, in said entitled cause, before the Honorable John P. Barnes, District Judge, appears the following entry, to wit:

1526 FINAL DECREE.

This Cause coming on for hearing and trial having been had in open court, the parties having been represented by counsel and having presented evidence and made arguments, and Findings of Fact and Conclusions of Law having been entered, it is Adjudged and Decreed, that:

1. Minneapolis-Honeywell Regulator Company is the owner of United States Letters Patent No. 1,813,732, issued July 7, 1931, to Edward E. Freeman, for Furnace Control.

2. Patent No. 1,813,732, to Freeman discloses invention and is valid (Civil Action No. 1839), and particularly as to claims 1, 4, 6 and 9 relied upon by Minneapolis-Honeywell (Civil Action No. 1842).

3. The Mercoid Corporation is a contributory infringer of claims 1, 4, 6 and 9 of the Freeman patent.

1527 4. Minneapolis-Honeywell has been so using its Freeman patent as to tend to create a monopoly in an unpatented device.

5. Each of the complaints herein is hereby dismissed for want of equity.

6. Each of the parties pay one-half of the taxable costs.

Enter:

Barnes,
United States District Judge.

Chicago, Illinois,
March 24, 1942.

1528 And on, to wit, the 25th day of March, A. D. 1942, came the Defendant by its attorneys and filed in the Clerk's office of said Court its certain Notice of Appeal in words and figures following, to wit: Filed March 25, 1942

1529 IN THE UNITED STATES DISTRICT COURT.

* * (Caption—1839) * *

NOTICE OF APPEAL.

Notice is hereby given that Minneapolis-Honeywell Regulator Company, defendant in Consolidated Case No. 1839, (Case No. 1839 being the number under which The Mercoid Corporation v. Minneapolis-Honeywell Regulator Company, No. 1839, was consolidated with Minneapolis-Honeywell Regulator Company v. The Mercoid Corporation, No. 1842), hereby appeals to the Circuit Court of Appeals for the Seventh Circuit from that part of the final judgment (decree) entered herein on the 24th day of March, 1942, dismissing its complaint in No. 1842 and adjudging that it has been so using its Freeman patent as to tend to create a monopoly in an unpatented device.

Bair & Freeman,
Attorneys for Appellant,
Minneapolis-Honeywell Regulator Company.

W. P. Bair,
Will Freeman,
George Fisher,
Of Counsel.

Dated:
Chicago, Illinois,
Mar. 25, 1942.

Filed March 26, 1942

1530 And on, to wit, the 26th day of March, A. D. 1942, came the defendant by its attorneys and filed in the Clerk's office of said Court its certain Statement of Points in words and figures following, to wit:

1531 IN THE UNITED STATES DISTRICT COURT.

* * (Caption—1839) * *

STATEMENT OF POINTS ON WHICH DEFENDANT WILL RELY ON APPEAL.

Minneapolis-Honeywell Regulator Company, defendant-appellant, (plaintiff in No. 1842 below), states that the following are the points upon which it relies in this appeal:

1. The Court erred in finding that Minneapolis-Honeywell Regulator Company has been so using its Freeman patent No. 1,813,732, as to tend to create a monopoly in an unpatented device.

2. The Court erred in not finding that the conduct of the Minneapolis-Honeywell Regulator Company, including its licensing practice, involved a fair exercise of its rights under the patent laws.

3. The Court erred in dismissing the Complaint of Minneapolis-Honeywell Regulator Company for want of equity.

1532 4. The Court erred in not ordering The Mercoid Corporation enjoined from further contributory infringement of said Freeman patent,

5. The Court erred in not ordering an accounting by The Mercoid Corporation for damages and profits on account of its contributory infringement.

Bair & Freeman,
Attorneys for Minneapolis-Honeywell Regulator Company.

W. P. Bair,
Will Freeman,
George Fisher.
Dated:
Chicago, Illinois,
March 26, 1942.

1533 And on, to wit, the 25th day of March, A. D. 1942, came the Defendant by its attorneys and filed in the Clark's office of said Court its certain Bond on Appeal in words and figures following, to wit: Filed March 25, 1942

1534 BOND ON APPEAL.

Know All Men by These Presents:

That we, Minneapolis-Honeywell Regulator Company, as principal, and Globe Indemnity Company, of New York, as sureties, are held and firmly bound unto The Mercoid Corporation, in the full and just sum of Two Hundred and Fifty Dollars ($250.00), to be paid to the said The Mercoid Corporation, or its attorneys, executors, administrators or assigns; to which payment, well and truly to be made, we bind ourselves, our heirs, executors, and administrators, jointly and severally, firmly by these presents. Sealed with our seals and dated this 25th day of March, 1942.

Whereas, lately at a session of the District Court of the United States for the Northern District of Illinois, in a suit pending between The Mercoid Corporation, Plaintiff, and Minneapolis-Honeywell Regulator Company, Defendant, Consolidated Case No. 1839, a decree as rendered against the said Minneapolis-Honeywell Regulator Company, and the said Minneapolis-Honeywell Regulator Company having filed its Notice of Appeal to the United States Circuit Court of Appeals for the Seventh Circuit in the Clerk's Office of the said District Court to reverse the decree of the aforesaid suit in the United States Circuit Court of Appeals for the Seventh Circuit, to be holden at Chicago within forty days from the date hereof.

Now, the condition of the above obligation is such, that if the said Minneapolis-Honeywell Regulator Com-
1535 pany shall prosecute its appeal to effect, and shall answer all costs that may be awarded against it if it fail to make its plea good, then the above obligation to be void; otherwise to remain in full force and virtue.

Minneapolis-Honeywell Regulator Company,
By Bair & Freeman,
Its Attorneys.

W. P. Bair,
Will Freeman,
George H. Fisher,
Of Counsel.

Globe Indemnity Company,
By (s) L. W. Zuttermeister,
L. W. Zuttermeister, Attorney in Fact.

1536 IN THE DISTRICT COURT OF THE UNITED STATES,

For the Northern District of Illinois,

Eastern Division.

CERTIFICATE OF MAILING.

I, Hoyt King, Clerk of the United States District Court, for the Northern District of Illinois, Eastern Division, keeper of the Seal and Records of said Court, do hereby certify that on the 26th day of March, 1942, in accordance with Rule 73 (b) of the Rules of Civil Procedure for District Courts of the United States, I did cause to be mailed a copy of the foregoing Notice of Appeal to the following attorneys of record:

Hoyt King.
Hoyt King, Clerk.

Langdon Moore, 53 West Jackson Blvd., 1132, Chicago, Illinois.

L. Kerans Moore, 53 West Jackson Blvd., Chicago, Illinois

(Seal)

1537 And on, to wit, the 7th day of April, A. D. 1942, came the Complainant Appellant by its attorneys and filed in the Clerk's office of said Court its certain Notice of appeal in words and figures following, to wit: Filed April 7, 1942

1538 IN THE DISTRICT COURT OF THE UNITED STATES.

* * (Caption—1839) * *

NOTICE OF APPEAL.

Notice is hereby given that The Mercoid Corporation, complainant in Consolidated Cause No. 1839, hereby appeals to the Circuit Court of Appeals for the Seventh Circuit, from that part of the Final Decree entered herein on the 24th day of March, 1942:

Dismissing its complaint for a declaratory decree (Civil Action No. 1839, Equitable Relief Sought) for want of equity;

Adjudging Letters Patent No. 1,813,732 to Edward E. Freeman discloses invention and is valid (Civil Action No. 1839) and particularly as to claims 1, 4, 6 and 9 relied upon by Minneapolis-Honeywell (Civil Action No. 1842);

Adjudging The Mercoid Corporation is a contributory infringer of claims 1, 4, 6 and 9 of the Freeman patent;

Dismissing the complaint of Minneapolis-Honeywell
1539 Regulator Company in Minneapolis-Honeywell Regulator Company vs. The Mercoid Corporation (Civil Action No. 1842), consolidated with Civil Action No. 1839, without passing upon the counterclaim for a declaratory decree filed therein by The Mercoid Corporation, and

Adjudging each of the parties pay one-half of the taxable costs.

Langdon Moore,
L. Kerans Moore,
Attorneys for The Mercoid Corporation,
53 West Jackson Boulevard,
Chicago, Illinois.

Dated:
Chicago, Illinois,
April 7, 1942.

Filed May 12, 1942

1540 And on, to wit, the 12th day of May, A. D. 1942, came the Appellant by its attorneys and filed in the Clerk's office of said Court its certain Points on Which It Will Rely in words and figures following, to wit:

1541 IN THE DISTRICT COURT OF THE UNITED STATES.

* * (Caption—1839) * *

POINTS TO BE RELIED UPON BY THE MERCOID CORPORATION.

1. The Court erred in finding the Freeman patent discloses invention over the prior patented art, publications and drawings relied upon by The Mercoid Corporation and that the Freeman patent is valid.

2. The Court erred in finding the prior public uses relied upon by The Mercoid Corporation were not installed in their present condition prior to January 16, 1931, the filing date of the Freeman patent.

3. The Court erred in adjudging The Mercoid Corporation is a contributory infringer of claims 1, 4, 6 and 9 of the Freeman patent.

4. Having found the Freeman patent is not a patent on either the fan switch, or the limit switch, or both of them, but a patent on a system of furnace control which requires three thermostats for its operation, the Court erred in not finding that, prior to January 16, 1931, the filing date of the Freeman patent, Williams Oil-O-Matic Heating Corporation had suggested in its Sheets A-198, dated May 5, 1927 (Mercoid Exhibit F-1) and JA-258, dated June 4, 1930 (Mercoid Exhibit G-1), the use of three thermostats for the operation of a system of furnace control defined in the claims of the Freeman patent.

1542 5. The Court erred in not finding that prior to January 16, 1391, the filing date of the Freeman patent, the Portner diagram (Mercoid Exhibit JJJ) accompanying the Portner letter, dated November 28, 1928 (Mercoid Exhibit HI), disclosed the use of three thermostats for the operation of a system of furnace control defined by the claims of the Freeman patent.

6. The Court erred in not finding the heating system installed in the Evangelical Church, Bloomington, Illinois, followed the suggestion of Williams Oil-O-Matic Heating Corporation combining the use of a room thermostat and

limit control as shown in Williams Oil-O-Matic Sheet No. A-150, dated December 24, 1925, with the use of a fan switch shown in Williams Oil-O-Matic Sheet No. A-67, dated October 19, 1926 (Mercoid Exhibit E-2).

7. The Court erred in finding the Evangelical Church heating system (Mercoid Exhibits A-1 to 4, inclusive) was not installed prior to the Freeman filing date of January 16, 1931.

8. The Court erred in not finding that a Mercoid Figure 50 with the tube reversed (circuit to close on temperature rise) as a fan control had been installed in the Evangelical Church prior to August, 1929 (Mercoid Exhibit Z).

9. The Court erred in finding the installation in the Evangelical Church was not a public use of more than two years prior to the Freeman filing date of January 16, 1931.

1543 10. The Court erred in finding the installation in the Portner establishment was not a public use prior to the Freeman filing date of January 16, 1931.

11. The Court having found:

(1) that the Teal patent discloses no fan for delivering the heating medium from the furnace to the room or space to be heated and no thermostat in the furnace hood for controlling a fan;

(2) that the Johnson patent 1,602,363, Mercoid's Bulletin D, dated April 1, 1924; Mercoid's Catalog H-3 of 1928, page 28; Oil-O-Matic drawing No. A-150 dated December 24, 1925, and wiring diagram No. 740 on page 31 of Mercoid Catalog H-5 dated 1929, all follow the Teal patent and lack the disclosure of a fan and a thermostat in the furnace hood for controlling a fan;

(3) that Edgecombe Reissue patent No. 15,531 discloses two room thermostats instead of one, as found in Freeman, and it has no limit switch or thermostat in the furnace hood for opening the circuit passing through the motor which drives the burner upon temperature rise in the furnace hood beyond a safe limit;

(4) that Mercoid's illustration No. 4 of Bulletin A-5 dated June 1930 discloses only a portion of the Edgecombe patent and differs from Freeman in that there is no disclosure of a limit switch or a combustion motor;

(5) that the Cross patent No. 1,758,146 differs from Freeman in that it has neither a fan thermostat nor a limit thermostat in the furnace hood;

1544 the Court erred in not finding Freeman had merely exercised mechanical skill in combining the disclosures of Teal, Edgecombe, Cross and Mercoid to produce a system of furnace control as disclosed in the Williams Sheets A-198 and JA-258 before the filing date of Freeman.

12. The Court having found:

(1) that Mercoid's drawing 266 dated September 27, 1927, differs from Freeman in that the limit switch is out into the circuit ahead of the room thermostat and this brings about an entirely different sequence of operation;

(2) that Drawing No. 748 of Mercoid Catalog No. H-5 of 1929 also places the limit switch ahead of the room thermostat, making an entirely different sequence of operation from that of Freeman;

(3) that neither Mercoid drawing No. 266 of September 27, 1927, nor drawing 748 of Mercoid Catalog H-5 of 1929 shows a limit switch between the room thermostat and combustion motor, as does Freeman,

the Court erred in not finding Freeman had merely exercised mechanical skill in placing the room thermostat in a system of furnace control in circuit ahead of the limit control and fan control as disclosed in Williams Sheets A-198 and JA-258 and in the Portner wiring diagram, which disclosures produce the same sequence of operation as Freeman, before the filing date of Freeman.

13. In view of the suggested wiring diagrams of Williams Oil-O-Matic Sheets A-198 and JA-258 and the
1545 wiring diagram of Portner suggested to The Mercoid Corporation, the Court erred in finding the sale of the Mercoid M-80 is a contributory infringement of claims 1, 4, 6 and 9 of the Freeman patent.

14. The Court erred in dismissing the complaint for declaratory decree that the claims of the Freeman patent were invalid after the admission by Minneapolis-Honeywell Regulator Company that claims 2, 5, 7 and 10 were invalid.

15. Having found that Minneapolis-Honeywell Regulator Company had used its Freeman patent so as to tend to create a monopoly in an unpatented article, the Court erred in not finding Minneapolis-Honeywell Regulator Company had violated the Anti-Trust Law of the United States.

16. Having found Minneapolis-Honeywell Regulator Company had licensed others under the Freeman patent to manufacture, use and sell an unpatented device, the Court erred in not finding Minneapolis-Honeywell Regulator Company had violated the Anti-Trust Law of the United States.

17. The Court erred in dismissing the complaint for declaratory decree of The Mercoid Corporation and not adjudging that complainant has the right to manufacture and sell its fan and limit controls, M-80, without molestation by the defendant.

18. The Court erred in dismissing the complaint for a declaratory decree of The Mercoid Corporation and not finding the defendant be restrained and enjoined from bringing suit for infringement of said Freeman patent against the purchasers of the combination fan and limit controls, M-80, for the purpose of resale, or directly
1546 or indirectly threatening such customers, or prospective customers, of The Mercoid Corporation with suit for infringement of said Freeman patent, or from in any manner interfering with the business of The Mercoid Corporation in the manufacture and sale of its fan and limit controls, M-80, by the use of the Freeman patent.

19. Having adjudged Minneapolis-Honeywell Regulator Company has been so using its Freeman patent as to tend to create a monopoly in an unpatented device and having dismissed Minneapolis-Honeywell Regulator Company's suit for infringement of the Freeman patent for want of equity (Cause No. 1842), the Court erred in not passing upon the counterclaim for a declaratory decree forming a part of The Mercoid Corporation's answer thereto.

20. The Court erred in finding the defense of Mercoid of laches by Minneapolis-Honeywell Regulator Company has not been established since there are no elements of estoppel involved and mere delay does not constitute a defense.

21. The Court erred in not finding the claims of the Freeman patent do not cover any valid and patentable combination, but embody merely aggregations of elements having no true or proper relation in a patentable sense, and that the claims do not cover, embody or constitute patentable subject matter and are therefore invalid in accordance with the Statutes and Laws of the United States.

22. The Court erred in not finding that the instructions to customers set forth in The Mercoid Corporation's
1547 correspondence during the years 1926, 1927, 1928 and 1929, described a system of furnace control as defined in the claims of the Freeman patent.

23. The Court erred in not finding that Minneapolis-Honeywell Regulator Company, by the use of its Freeman

patent, had entered into unfair competition with The Mercoid Corporation.

24. The Court erred in not finding that Minneapolis-Honeywell Regulator Company had deliberately conspired with its licensees and said licensees and Minneapolis-Honeywell Regulator Company have wilfully and unlawfully conspired among themselves to substantially lessen competition and establish a monopoly in the sale of furnace controls in restraint of trade and in violation of the Anti-Trust Law.

25. The Court erred in not entering a decree that an accounting be awarded to The Mercoid Corporation for Minneapolis-Honeywell Regulator Company's profits, gains and advantages and the damage sustained by The Mercoid Corporation because of the wrongful acts of Minneapolis-Honeywell Regulator Company.

26. The Court erred in not adjudging The Mercoid Corporation is entitled to injunctive relief under the Anti-Trust Law of the United States.

27. The Court erred in not finding Minneapolis-Honeywell Regulator Company has violated the Anti-Trust Law of the United States by establishing a price upon an unpatented article.

1548 28. The Court erred in adjudging that each of the parties pay one-half of the taxable costs.

The Mercoid Corporation,
By Langdon Moore,
L. Kerans Moore,
Its Attorneys,
53 West Jackson Boulevard,
Chicago, Illinois.

Dated: Chicago, Illinois,
5-12, 1942.

1549 In the District Court of the United States,

For the Northern District of Illinois,

Eastern Division.

CERTIFICATE OF MAILING.

I, Hoyt King, Clerk of the United States District Court, for the Northern District of Illinois, Eastern Division, keeper of the Seal and Records of said Court, do hereby certify that on the 8th day of April, 1942, in accordance with Rule 73 (b) of the Rules of Civil Procedure for District Courts of the United States, I did cause to be mailed a copy of the foregoing Notice of Appeal to the following attorneys of record:

Bair & Freeman,
135 S. LaSalle Street, 1400,
Chicago, Illinois.

(Seal) Hoyt King, Clerk.

1550 And on, to wit, the 7th day of April, A. D. 1942, came the Complainant-Appellant by its attorneys and filed in the Clerk's office of said Court its certain BOND ON APPEAL in words and figures following, to wit: Filed April 7, 1942

1551 Know All Men By These Presents:

That we, The Mercoid Corporation, as principal, and Hartford Accident and Indemnity Company, as sureties, are held and firmly bound unto Minneapolis-Honeywell Regulator Company in the full and just sum of Two Hundred and Fifty and no/100 ($250.00) Dollars to be paid to the said Minneapolis-Honeywell Regulator Company, its attorneys, executors, administrators, or assigns; to which payment, well and truly to be made, we bind ourselves, our heirs, executors, and administrators, jointly and severally, firmly by these presents. Sealed with our seals and dated this 6th day of April, in the year of our Lord one thousand nine hundred and forty two.

Whereas, lately at a session of the District Court of the United States for the Northern District of Illinois, Eastern Division, in a suit pending in said Court, between The Mercoid Corporation, plaintiff, and Minneapolis-Honeywell

Regulator Company, defendant, a decree was rendered against said The Mercoid Corporation, and said The Mercoid Corporation having filed its notice of appeal to the United States Circuit Court of Appeals for the Seventh Circuit in the Clerk's Office of the said District Court to reverse the decree of the aforesaid suit in the United States Circuit Court of Appeals for the Seventh Circuit, to be holden at Chicago within forty days from the date hereof.

Now, the condition of the above obligation is such, that if said The Mercoid Corporation shall prosecute its said appeal to effect, and shall answer all damages and
1552 costs that may be awarded against it if it fail to make its plea good, then the above obligation to be void; otherwise to remain in full force and virtue.

The Mercoid Corporation.
By Hugh Courteol,
President.

(Seal)
Attest:
J. F. Chambliss,
Secretary.

Hartford Accident and Indemnity Company,
By Arthur A. Noll,
Its Attorney-in-Fact.

(Seal)

State of Illinois }
County of Cook } ss.

On this 6th day of April, A. D. 1942, before me the undersigned, a Notary Public, within and for the said county and state, personally appeared Hugh Courteol, President, and J. F. Chambliss, Secretary, of the above named The Mercoid Corporation, to me known to be the persons who executed the foregoing instrument, and to me known to be such President and Secretary of said corporation, and ac-
1553 knowledged that they executed the foregoing instrument as such officers as the deed of said corporation, by its authority.

Albert Schiff,
Notary Public.

(Seal)

State of Illinois }
County of Cook } ss.

On this 6th day of April, A. D. 1942, before me, the undersigned, a Notary Public, within and for said county and state, personally Arthur A. Noll, Attorney-in-Fact of the above named Hartford Accident and Indemnity Company to me known to be the person who executed the foregoing instrument, and to me known to be such Attorney-in-Fact of said corporation, and acknowledged that he executed the foregoing instrument as such Attorney-in-Fact, as the deed of said corporation, by its authority.

Beryl M. Radcliffe,
(Seal) Notary Public.

1554 And on, to wit, the 26th day of March, A. D. 1942, came the Defendant by its attorneys and filed in the Clerk's office of said Court its certain Designation of Portions of the Record in words and figures following, to wit: Filed March 2[illegible] 1942

1555 In the United States District Court.

* * (Caption—1839) * *

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY'S DESIGNATION OF THE PORTIONS OF THE RECORD, PROCEEDINGS AND EVIDENCE TO BE CONTAINED IN THE RECORD ON APPEAL.

The Clerk will please prepare the record on appeal herein and include the following, with filing dates of the pleadings (Pleadings in Civil Action No. 1842 only):

1. Complaint, including Ex. 1, the Freeman patent No. 1,813,732, and omitting verification and other exhibits attached.
2. Defendant's (Mercoid) Motion for Bill of Particulars (omitting attached exhibits).
3. Plaintiff's Bill of Particulars.
4. Defendant's Interrogatories.
5. Plaintiff's Answers to Defendant's Interrogatories (omitting the exhibits attached; Ex. A attached is Mercoid's Ex. LL; the Cook license attached is the same in all pertinent respects as Mercoid's Ex. HH; the Penn Electric Switch Co., Perfex Corporation, Bendix Aviation Corporation and White-Rodgers Electric Co. licenses attached are the same in all pertinent respects as Mercoid Ex. JJ).

1556 6. Answer with Counterclaim (omitting verification and exhibits attached). (Exs. B, C, Price Schedule, D & G are identical in all pertinent respects with Exs. GG, HH, LL, QQ and II respectively).

7. Amendment to Answer with Counterclaim.

8. Reply to Counterclaim.

9. Request for Admission of Facts and Genuineness of Documents under Rule 75, Rules of Civil Procedure.

10. Order for Consolidation, entered in Case No. 1842 and Case No. 1839, on June 20, 1941.

11. Memorandum entered by Judge Barnes February 27, 1942.

12. Findings of Fact and Conclusions of Law.

13. Final Degree.

14. Notice of Appeal.

15. Bond.

16. Statement of Points to be Relied Upon.

17. That portion of the Reporter's typewritten transcript of the proceedings at the trial, comprising:

Pages 41 to 65 inclusive, omitting last two lines of page 65.

Page 66, last 5 lines only.

Pages 67 to 100, omitting last three lines.

Pages 101 to 131, inclusive.

Pages 644 to 682, inclusive.

Page 814, last eleven lines.

Pages 815 to 820, omitting last eight lines.

1557 18. Minneapolis-Honeywell Regulator Company's documentary exhibits, as follows:

Ex. 1-A, Mercoid Corporation "Installation Instructions", May, 1940, Form L-4.

Ex. 7, Mercoid Combination Fan and Limit Control for Warm Air Furnaces, Bulletin M-12.

Ex. 13, Sequence Drawing of Freeman patent.

Ex. 30, Letter April 18, 1939, from Minneapolis-Honeywell to Perfex Corporation.

Ex. 31, Letter September 5, 1940, from Perfex to Minneapolis-Honeywell; Letter September 6, 1940, Minneapolis-Honeywell to Perfex; corrected letter of August 20, 1940.

19. Mercoid Corporation's documentary exhibits, as follows:

Ex. T, Minneapolis-Honeywell catalog 1940, cover and page 40.

Ex. GG, January 24, 1940, Letter, Minneapolis-Honeywell to Mercoid.

Ex. HH, typewritten copy proposed license Minneapolis-Honeywell to Mercoid.

Ex. II, May 7, 1940, letter, Minneapolis-Honeywell to Detroit Lubricator and Mercoid, with two letters attached.

Ex. JJ, Minneapolis-Honeywell printed license under Freeman patent.

Ex. LL, Price schedule, used with all licenses under Freeman patent.

Ex. QQ, June 21, 1940, letter, Minneapolis-Honeywell to Mercoid.

Ex. RR, June 28, 1940, letter, Mercoid to Minneapolis-Honeywell.

Ex. SS, October 7, 1940, letter, Minneapolis-Honeywell to Mercoid.

1558 20. Minneapolis-Honeywell Regulator Company's physical exhibits (to be forwarded to the Clerk of the Seventh Circuit Court of Appeals):

Ex. 15, Demonstration Model, including Minneapolis-Honeywell commercial control marketed under Freeman patent.

Ex. 17, Colored photograph of the demonstration model of Ex. 15.

Ex. 18, Demonstration Model, including a specimen of Mercoid's M-80 accused control.

Ex. 20, Colored photograph of Ex. 18 Demonstration Model.

21. Mercoid Corporation's physical exhibits (to be forwarded to the Clerk of the Seventh Circuit Court of Appeals):

Ex. PPP, Mercoid Type M-80 accused control (separate control, like the M-80 used in M-H Ex. 18).

22. This Designation.

23. Clerk's Certificate.

Minneapolis-Honeywell Regulator Company,
By Bair & Freeman,
Its Attorneys.

W. P. Bair,
Will Freeman,
George Fisher,
Of Counsel.

Dated:
Chicago, Illinois,
March 26th, 1942.

Filed May 12, 1942

1559 And on, to wit, the 12th day of May, A. D. 1942, came the Appellant by its attorneys and filed in the Clerk's office of said Court its certain Designation of Contents of Record in words and figures following, to wit:

1560 IN THE DISTRICT COURT OF THE UNITED STATES.

* * (Caption—1839) * *

THE MERCOID CORPORATION'S DESIGNATION OF THE PORTIONS OF THE RECORD, PROCEEDINGS AND EVIDENCE TO BE CONTAINED IN THE RECORD ON APPEAL.

The Clerk will please prepare the record on appeal herein and include the following, with filing dates of the pleadings (Pleadings in Civil Action No. 1839 only):

1. Complaint for Declaratory Decree (omitting attached Verification and exhibits) filed June 29, 1940.
2. Answer filed July 19, 1940.
3. Complainant's (Mercoid) Interrogatories filed August 12, 1940.
4. Defendant's (Minneapolis) Interrogatories filed August 20, 1940.
5. Minneapolis' Answer to Complainant's Interrogatories filed August 28, 1940 (omitting attached exhibits).
6. Mercoid's Answer to Minneapolis' Interrogatories filed September 3, 1940 (omitting attached exhibits).
7. Amendment to Bill of Complaint filed October 3, 140.

1561 8. Minneapolis' Amendment to Answer filed October 17, 1940.

9. Supplemental Complaint (omitting attached exhibits) filed January 7, 1941.
10. Minneapolis' Reply to Supplemental Complaint filed January 27, 1941.
11. Mercoid's Request for Admission of Facts and Genuineness of Documents filed February 20, 1941.
12. Amendment to Supplemental Complaint filed November 12, 1941.
13. Notice of Appeal, April 7, 1942.
14. Bond.
15. Statement of Points to be Relied Upon.
16. That portion of the Reporter's typewritten transcript of the proceedings at the trial comprising:

Page 133, last 13 lines only.
Page 134 to 138, inclusive, including only the first four lines on page 138.
Page 139, omitting first seven lines.
Page 140 to 153, including first seven lines only on page 153. (Introduction and excerpts of the typewritten depositions of Willard L. Huff and Harold W. Sweatt.)
Page 153, including last 10 lines only.
Pages 154 to 193, omitting last three lines on page 193.
1562 Page 194, last seven lines only.
Pages 195 to 261, omitting last five lines on page 261.
Page 262, last six lines only.
Pages 263 to 306, omitting last three lines on page 306.
Page 307, last six lines only.
Page 308 to 362, omitting last four lines on page 362.
Page 363, last six lines only.
Pages 364 to 398, omitting first five lines on page 398.
Pages 399 to 418, omitting last four lines on page 418.
Page 419, last six lines only.
Pages 420 to 458, including the first six lines only on page 458.
Page 557, omitting the first six lines.
Pages 558 to 566, omitting the last five lines on page 566.
Page 600, last three lines only.
Pages 601 to 626, omitting last five lines on page 626.
Page 627, last 10 lines only.
Page 628, omitting first two lines.
Page 629 to 643, omitting last 11 lines on page 643. (Testimony of Frank Black.)
Pages 459 to 461, inclusive. (Testimony of Paul Brodersen.)
Page 462, omitting first three lines.
Pages 463 to 488, omitting last two lines on page 488.
Page 489, last five lines only.
1563 Page 490 to 525, omitting last five lines on page 525.
Page 567, omitting first six lines.
Page 568 to 600, including first 10 lines only on page 600. (Testimony of J. A. Portner.)
Page 526 to 542, omitting last four lines on page 542.
Page 543, last six lines only.
Page 544 to 556, omitting last four lines on page 556. (Testimony of Charles Hill.)

Page 683 to 688, inclusive, omitting last two lines on page 688.
Page 689, last 12 lines only.
Page 690 to 691, omitting last two lines on page 691. (Introduction of Bloomington depositions and reference to Owens' interpretation of dates.)
Page 692, omitting first two lines.
Page 693 to 749, omitting the last five lines on page 749.
Page 750, last six lines only.
Page 751 to 787, including the first six lines only on page 787. (Testimony of Harry R. Van Deventer.)
Pages 825 to 831, first three lines only on page 831. (Statement as to dates as interpreted by James W. Owens.)

1564 17. That portion of the Bloomington depositions (Mercoid Exhibit A) comprising:
Beginning with Q. 1 on Page 45 through A. 8 on Page 46.
Beginning with Q. 38 on Page 52 through A. 143 on Page 68.
Beginning with Q. 160 on Page 70 through A. 242 on Page 86.
Beginning with Q. 289 on Page 95 through A. 374 on page 114. (Testimony of O. H. Price.)
Beginning with Q. 1 on Page 154 through A. 79 on Page 161.
Beginning with Q. 83 on Page 162 through A. 218 on Page 182. (Testimony of Louis H. Lartz.)

18. The Mercoid Corporation's documentary exhibits as follows:
Exhibits A-1-2-3-4, Photographs of Installation in Evangelical Church.
Exhibits C-1-2-3, Invoices to Evangelical Church from records of Williams Oil-O-Matic.
Exhibit D-4, Ledger sheet from records of Williams Oil-O-Matic.
Exhibit E-2, Installation and Service Manual of Williams Oil-O-Matic, Cover, Index Sheets 1 and 2, Sheet A-67, Sheet A-150 only.
Exhibit F-1, Sheet A-198 wiring diagram.
Exhibit F-3, Sheet A-198 wiring diagram colored.
Exhibit G-1, Sheet No. JA-258 wiring diagram.
Exhibit G-4, Sheet No. JA-258 wiring diagram colored.

Exhibit H-3, Wiring diagram of installation Evangelical Church colored.

Exhibit L, Baker patent No. 2,230,446.

Exhibit N, Agreement: Minneapolis-Honeywell Regulator Company and Cook Electric Company re Baker patent.

1565 Exhibit R-1, Mercoid Manufacturer's Purchase Contract, 1938.

Exhibit R-2, Mercoid Manufacturer's Purchase Contract, 1939.

Exhibit R-3, Mercoid Manufacturer's Purchase Contract 1940.

Exhibit S, Minneapolis-Honeywell Regulator Company letter November 28, 1932.

Exhibit U, Bulletin D, Federal Mercoid Controls, Date Sheet No. 1, Cover only.

Exhibit V, Mercoid Bulletin E, June 1924, four sheets.

Exhibit X, Mercoid Catalog H-3, 1928, Title page and pages 10, 18, 23 and 28.

Exhibit Y, Mercoid Catalog No. H 5, 1929, Cover, Pages 7, 10, 24, 25, 31 and 32 only.

Exhibit Z Mercoid Bulletin S-83, four pages.

Exhibit AA, Mercoid Bulletin A-5, four sheets.

Exhibit BB, Mercoid Bulletin A-14, Cover and pages 1 and 7 only.

Exhibit CC, Mercoid Bulletin M-12.

Exhibit EE, Mercoid Installation Instructions Form P-55, September 1934, Sheet with wiring diagram only.

Exhibit KK, Minneapolis-Honeywell License to Cook Electric Company, March 31, 1939.

Exhibit MM, Letter from Thiess, Olson and Mecklenburger.

Exhibit WW, McCabe patent No. 1,734,015.

Exhibit XX, Mercoid Drawing No. 266.

1566 Exhibit ZZ, McCabe patent No. 1,817,634.

Exhibit AAA, McCabe patent No. 1,834,288.

Exhibit CCC, Peninsula Burner correspondence, 1926.

Exhibit DDD, Miller Automatic Service correspondence 1926.

Exhibit EEE, Carbon copy letter to Premier Warm Air Heater Company April 22, 1927.

Exhibit FFF, Carbon copy letter to Socony Burner Corp. December 29, 1927.

Exhibit GGG, The XXth Century Heating and Ventilating Company correspondence 1928.

Exhibit HHH, Holland Furnace Company correspondence 1929.

Exhibit III, J. A. Portner letter November 22, 1928.

Exhibit JJJ, J. A. Portner wiring diagram.

Exhibit KKK-1 Mercoid Invoice to J. A. Portner.

Exhibit LLL, Portner letter announcing opening and carbon copy of letter to Portner March 5, 1929.

Exhibit MMM-1-2-3-4, Photographs of installation on J. A. Porter's establishment.

Exhibit NNN-1, Johnson Patent No. 360,223.

Exhibit NNN-2, Kilbourn patent.

Exhibit NNN-3, Cross patent.

Exhibit NNN-4, Kuntz patent.

Exhibit NNN-5, Teal patent.

Exhibit NNN-6, Johnson patent No. 1,602,363.

Exhibit NNN-7, Sweatt patent.

Exhibit NNN-8, Edgecombe reissue patent.

1567 19. The Mercoid Corporation's physical exhibits as follows:

Exhibit BB-1, Enlarged wiring diagram No. 3 with circuits in color.

Exhibit CC-1, Enlarged wiring diagram Mercoid Bulletin M-12 with circuits in color.

Exhibit EE-1, Enlarged wiring diagram Form P-55 with circuits in color.

Exhibit VV, Enlarged Figure 2 of Freeman patent with circuits in color.

Exhibit YY, Enlarged Mercoid Drawing No. 266 with circuits in color.

Exhibit JJJ-1, Enlarged wiring diagram Portner installation with circuits in color.

Exhibit OOO, Mercoid Instrument M-51.

Exhibit OOO-1, Mercoid Instrument M-53.

Exhibit OOO-2, Mercoid Instrument M-52.

Exhibit QQQ, Enlarged drawing with three circuits in color.

20. Order: Physical Exhibits of The Mercoid Corporation be sent to the Circuit Court of Appeals. (Entered April 22, 1942.)

21. This designation of record.
22. Order: Entered April 27, 1942.
23. Clerk's Certificate.

The Mercoid Corporation.
By Langdon Moore,
L. Kerans Moore,
Its Attorneys.
53 West Jackson Boulevard,
Chicago, Illinois.

Dated:
Chicago, Illinois,
May 12, 1942.

1568 In the District Court of the United States.

* * (Caption—1839) * *

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY'S DESIGNATION OF ADDITIONAL PORTIONS OF RECORD, PROCEEDINGS, AND EVIDENCE TO BE CONTAINED IN THE RECORD OF THE MERCOID CORPORATION'S APPEAL.

The Clerk will please include the following portions in addition to those heretofore designated by The Mercoid Corporation:

1. That part of the portion of the Reporter's Typewritten Transcript of the proceedings at the trial comprising—
   Page 787, last 11 lines;
   Pages 788 to 798, omitting last 8 lines;
   Page 799, last 8 lines only;
   Page 800, first 8 lines;
   Page 802, last 7 lines only;
   Pages 803 to 814, except last 11 lines.
2. That part of Mercoid's Exhibit A (Bloomington depositions), and in addition to those parts already designated by Mercoid, comprising—

1569 Page 18, the name of the witness Hopkins, and the last 6 lines;
   Pages 19 to 28;
   Pages 30 to 40;
   Page 68, except first 5 lines;
   Page 69;
   Page 70, first 8 lines;
   Page 86, except first 8 lines;

Pages 87 to 94;
Page 95, except last 7 lines;
Page 115, last 10 lines;
Pages 116 to 152;
Page 153, first 2 lines;
Page 182, except first 7 lines;
Pages 183 to 232;
Page 233, except last 4 lines.

3. That part of Minneapolis-Honeywell's Exhibit 32 (depositions of McCabe and Courteol), comprising—

Page 8, omitting the first 6 lines;
Page 9, first 2 lines;
Page 10, omitting first 7 lines;
Page 11, first 6 lines and last 3 lines;
Pages 12 to 15;
Page 16, omitting last 6 lines;
Page 17, omitting first 12 lines;
Page 18;
Page 19, omitting last 8 lines;
Page 35, last 9 lines;
Page 36, first 5 lines;
Page 37, omitting first 4 lines;
1570 Pages 38 to 46;
Page 47, omitting last 10 lines;
Page 49, last 2 lines;
Pages 50 to 56;
Page 57, omitting last 7 lines;
Page 68, omitting first lines;
Pages 69 to 71;
Page 72, first 6 lines;
Page 81, last 3 lines;
Page 82, first 7 lines;
Page 95, omitting first 11 lines;
Page 96, omitting first 12 lines;
Page 97, first 9 lines;
Page 116, name of witness Courteol, and Question 95 and Answer thereto;
Page 148, Question 449 and Answer thereto;
Page 150, last 12 lines;
Page 151;
Page 152, omitting last 7 lines.

4. That part of Minneapolis-Honeywell's Exhibit 33 (Barr deposition) comprising—

Page 2, omitting first 4 lines;
Page 3;

Page 5;
Page 6, last 3 lines;
Pages 7 and 8;
Page 10, omitting last 3 lines;
Page 11, last 2 lines.

1571 5. Minneapolis-Honeywell's documentary exhibits, comprising—

Exhibit 1-B, Installation Instruction Bulletin, Form P-55-A, Feb. 1940;
Exhibits 2-A to 2-G, inclusive, Drawings referring to Illustration No. 7, wiring hook-up or circuit for M-80 as recommended by Mercoid;
Exhibit 3, group of 8 drawings, reproduced from Illustration No. 8 of M-H Ex. 1-A;
Exhibit 6, Mercoid drawing No. 962;
Exhibit 8, Mercoid Catalog No. 300;
Exhibit 9, Mercoid Catalog No. 400;
Exhibit 12, M-H drawing illustrating XX Century correspondence (Mercoid's Exhibit GGG);
Exhibit 26, Copy of Time-O-Stat Controls Co. name plate drawing N-350, March 11, 1929;
Exhibit 28, Drawing No. N-223 of name plate, March 13, 1929.
Exhibit 29, Drawing of N-350 of name plate, March 3, 1931.

6. Minneapolis-Honeywell's physical exhibits, comprising—

Exhibit 10, Booklet, "Mercoid Wiring Diagrams for Oil Burner Installations";
Exhibit 11, Booklet, Mercoid, with respect to stoker installations;
Exhibit 21, Drawing, Mercoid Control of M-H Ex. 1-A, and claim block referring to claim 4 of Freeman;
Exhibit 22, Drawing (of Ex. 21) and claim block referring to claim 9 of Freeman;
Exhibit 23, Chart of drawing No. 2403 in M-H Exhibit 10;
Exhibit 24, Claim block of Claim 6 of Freeman;
1572 Exhibit 25, Name plate corresponding to name plate on device in Portner installation;
Exhibit 27, Calibration plate of No. 56 instrument corresponding to plate at Portner installation.

7. Mercoid Corporation's documentary exhibits, comprising—

Exhibits B-1 and B-2, photographs of Ned Dolan residence installation (10-2-40);
Exhibit D-1, Williams Oil-O-Matic invoice to Ned Dolan (7-27-26);
Exhibit D-2, Williams Oil-O-Matic invoice to Ned Dolan (4-11-27);
Exhibit D-3, Williams Oil-O-Matic invoice to Ned Dolan (6-1-26);
Exhibit H-1, Williams Oil-O-Matic Drawings (10-2-1940) of Evangelical Church Installation;
Exhibit H-2, Williams Oil-O-Matic Drawings of Evangelical Church Installation;
Exhibit H-4, Williams Oil-O-Matic Drawings of Evangelical Church Installation;
Exhibit I-1, Williams Oil-O-Matic Drawing (Oct. 2, 1940) of Ned Dolan Installation;
Exhibits I-2 to I-6, inclusive, Williams Oil-O-Matic Drawings of Ned Dolan Installation;
Exhibit J-1, Minneapolis-Honeywell Catalog, (5-28), pages 2, 26 and back;
Exhibit J-3, Minneapolis-Heat Regulator Catalog; cover, title page and page 18;
Exhibit J-4, Heating Specialties Catalog; title page and page 22;
Exhibit O, Chicago Depositions of Willard L. Huff and Harold W. Sweatt; pages 3 to 27 inclusive;
Exhibit RRR, Time-O-Stat Catalog; Cover, title page O-1 and pages O-26 and O-27.

1573 8. Mercoid Corporation's physical exhibit, comprising—
Exhibit TTT (8 invoices to Portner).

9. This Designation.

Minneapolis-Honeywell Regulator Company,
By (s.) Bair & Freeman,
Its Attorneys.

Of Counsel:
(s.) Bair &
(s.) Will Freeman.
(Chicago, Illinois,
May 16, 1942.)

1574 IN THE DISTRICT COURT OF THE UNITED STATES.

* * (Caption—1839) * *

AMENDMENT TO MERCOID'S DESIGNATION OF THE PORTIONS OF THE RECORD, PROCEEDINGS AND EVIDENCE TO BE CONTAINED IN THE RECORD ON APPEAL.

The Clerk will please include the following portions in addition to those heretofore designated by The Mercoid Corporation and those included in the additional designation of Minneapolis-Honeywell Regulator Company:

1. That portion of the Mercoid's Exhibit A (Bloomington depositions), omitted from Minneapolis-Honeywell's additional designation, comprising:

Page 15, omitting first 10 lines.
Page 16.
Page 41, first 8 lines only.
Page 42, omitting first 10 lines.
Page 43.
Page 44, first line only.

2. That portion of Minneapolis-Honeywell's Exhibit 32 (depositions of McCabe and Courteol), omitted from Minneapolis-Honeywell's additional designation, comprising:

Page 23, omitting line 1 and last 6 lines.
Page 24, first 8 lines only.
Page 25, last 2 lines.
1575 Page 26 to and including page 35 to line 9 from bottom.
Page 72 omitting first 6 lines.
Pages 73 to 81, inclusive, omitting last 3 lines from bottom.
Page 82 omitting first 7 lines.
Pages 83 to 88, inclusive.
Page 89 first 2 lines.
Pages 90 to 94, inclusive.
Page 95 including first 11 lines.
Page 96 first 11 lines.
Page 98 omitting first 11 lines.
Pages 99 to 120, inclusive.
Page 124 omitting first 8 lines.
Pages 125 to 147, inclusive.
Page 148, first 9 lines and last 2 lines.

Page 149.
Page 150 omitting last 12 lines.
3. This designation.

The Mercoid Corporation,
By Langdon Moore,
L. Kerans Moore,
Its Attorneys,
53 West Jackson Boulevard,
Chicago, Illinois.

Dated: Chicago, Illinois,
May 18, 1942.

Filed April 22, 1942

1576 And afterwards, to wit, on the 22nd day of April, A. D. 1942, being one of the days of the regular April term of said Court, in the record of proceedings thereof, in said entitled cause, before the Honorable John P. Barnes, District Judge, appears the following entry, to wit:

1577 In the District Court of the United States.

* * (Caption—1839) * *

ORDER.

Upon motion duly made under Rule 75(i), it is hereby ordered that the following physical exhibits of The Mercoid Corporation introduced at the trial of the above entitled cause of action be sent to the Circuit Court of Appeals for the Seventh Circuit in order that the same may be inspected by the appellate court:

Exhibit BB-1, Enlarged wiring diagram No. 3 with circuits in color.
Exhibit CC-1, Enlarged wiring diagram Mercoid Bulletin M-12 with circuits in color.
Exhibit EE-1, Enlarged wiring diagram Form P-55 with circuits in color.
Exhibit VV, Enlarged Figure 2 of Freeman patent with circuits in color.
Exhibit YY, Enlarged Mercoid Drawing No. 266 with circuits in color.
Exhibit JJJ-1, Enlarged wiring diagram Portner installation with circuits in color.
Exhibit OOO, Mercoid Instrument M-54.
Exhibit OOO-1, Mercoid Instrument M-53.

1578 Exhibit OOO-2, Mercoid Instrument M-52.
Exhibit PPP, Mercoid Instrument M-80.
Exhibit QQQ, Enlarged wiring diagram with three circuits in color.

Barnes,
Judge of the United States District Court.

Dated: April 22nd, 1942.

1579 And afterwards, to wit, on the 27th day of April, A. D. 1942, being one of the days of the regular April term of said Court, in the record of proceedings thereof, in said entitled cause, before the Honorable John P. Barnes, District Judge, appears the following entry, to wit: Filed April 27, 1942

1580 In the District Court of the United States.

* * (Caption—1839) * *

ORDER.

Upon all the proceedings had herein and upon the annexed Stipulation, it is hereby ordered that:

The time for docketing the case and filing the record on appeal be and the same is hereby extended to and including May 23, 1942.

Barnes,
United States District Judge.

Dated:
Chicago, Illinois,
April 27th, 1942.

PLAINTIFF'S EXHIBIT 1

FREEMAN PATENT, NO. 1,813,732.

July 7, 1931. E. E. FREEMAN 1,813,732

FURNACE CONTROL

Filed Jan. 16, 1931

FIG. 1

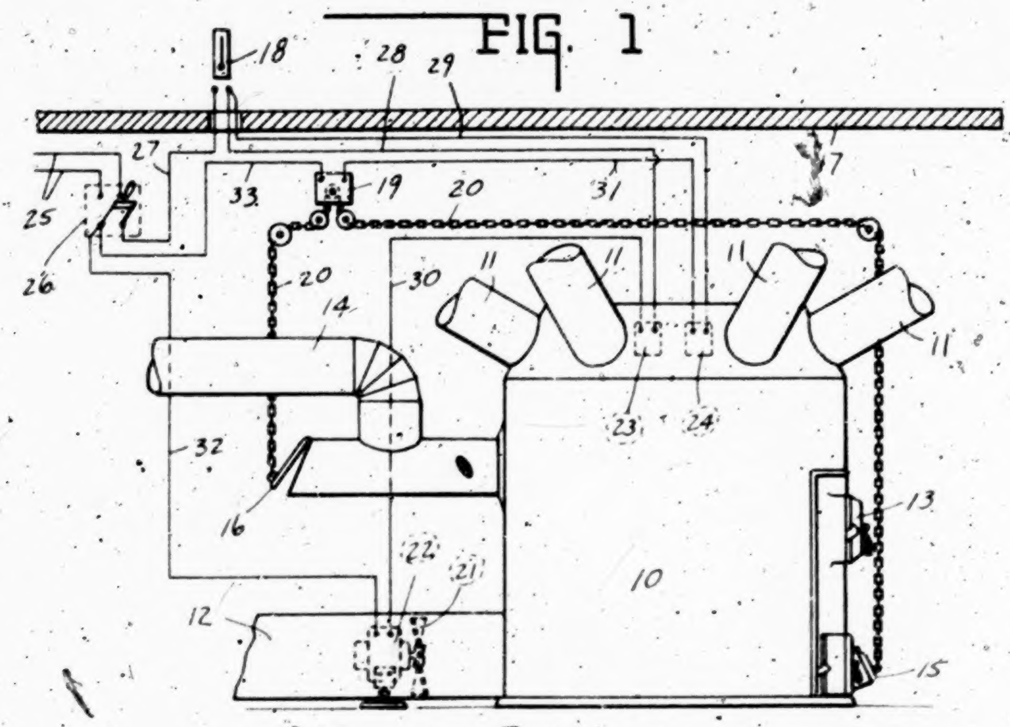
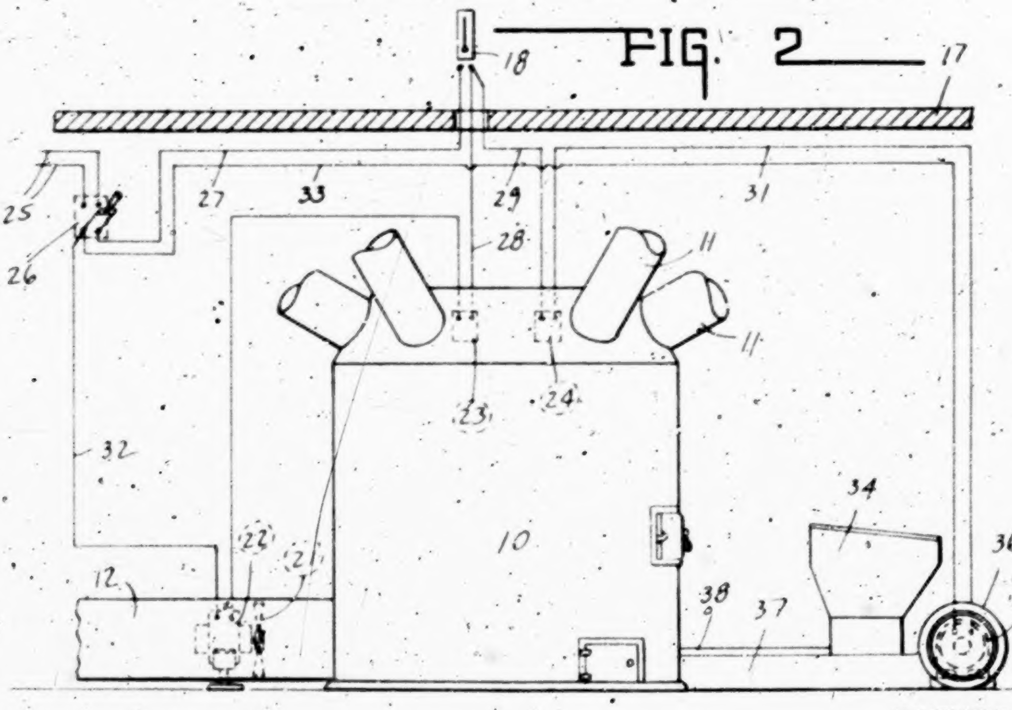


FIG. 2



INVENTOR.
EDWARD E. FREEMAN.

BY
Lockwood Lockwood Goldsmith & Galt
ATTORNEYS.

Patented July 7, 1931 1,813,732

1101

UNITED STATES PATENT OFFICE

EDWARD E. FREEMAN, OF DANVILLE, ILLINOIS

FURNACE CONTROL

Application filed January 16, 1931. Serial No. 509,049.

This invention relates to control apparatus, principally for use with a hot air furnace.

The principal object of the invention is to provide a control for the rate of combustion and for the operation of an accelerating device, such as a fan, blower or similar apparatus, used for accelerating the rate of supply of the heat-conducting medium, such as air, to be heated by the furnace, said control being such as to permit the operation of said accelerating device and to check combustion in case the furnace becomes overheated and such as to interrupt the operation of said accelerating device while increasing the rate of combustion if the furnace has not been heated above a predetermined temperature.

In addition, a control feature is added by means of which both the combustion and the supply of the heat-conducting medium are checked when the temperature of the room or object to be heated is above a predetermined degree.

Other objects and features of the invention will be apparent from the accompanying drawings and the following description and claims:

Figure 1 is an elevational view partly diagrammatic showing the application of the invention to a hand-fired, hot air furnace. Figure 2 is a similar view showing the invention applied to a stoker-fired furnace.

In Figure 1 a furnace 10 is fitted with the usual hot air pipes 11, cold air inlet 12, fire door 13, smoke pipe 14 and draft dampers 15 and 16. The floor of a room to be heated is indicated by the numeral 17 and a thermostat 18 is located within the said room. An electrically-operated damper controller 19 of a common commercial form is connected by means of chains 20 with the dampers 15 and 16 and is adapted to accelerate the combustion by moving the said chains to open damper 15 and close damper 16 when electric current is supplied to said controller. When no current is supplied, the controller operates to check combustion by moving the chains in the opposite direction. A fan 21 and motor 22 are associated with the cold air inlet 12 to accelerate the supply of cold air to the furnace. A pair of thermostatic switches 23 and 24 are located within the hood of the furnace. Suitable electric power for the operation of the damper controller 19 and the fan motor 22 is supplied by means of power mains 25 connected to a knife switch 26. One terminal of the said knife switch is connected by means of a wire 27 to the thermostat 18. The opposite terminal of the thermostat is connected by a pair of wires 28 and 29 to the thermostatic switches 23 and 24 respectively. The opposite terminal of switch 23 is connected by a wire 30 with one terminal of the fan motor 22. The opposite terminal of the switch 24 is connected by a wire 31 with the damper controller 19. The opposite terminals of the fan motor 22 and damper controller 19 are connected to the second terminal of the knife switch by wires 32 and 33 respectively.

In the operation of the apparatus, the fan motor 22 is operated when the following electric circuit is completed: 25, 26, 27, 18, 28, 23, 30, 22, 32, 26, 25. The damper controller 19 is actuated to accelerate combustion when the following circuit is completed: 25, 26, 27, 18, 29, 24, 31, 19, 33, 26 and 25. When this circuit is broken, the damper controller is adapted to move the dampers to check the fire. Since the thermostat 18 is included in both these circuits and since the said thermostat is of the type to open its circuit when the room temperature is above a predetermined value, it is evident that the fan 21 will be stopped and the damper control will operate to check the fire whenever this predetermined room temperature is exceeded.

The switch 23 is of a type which closes its circuit only when a predetermined temperature is exceeded. This temperature is so chosen that the circuit within the switch 23 is only completed when the furnace hood has been heated to a temperature greater than normal room temperature. Thus the fan 21 will not be operated if the furunace has not reached a temperature at which the air would be heated above room temperature. In other words, the fan 21 can never operate to force unheated air into the rooms to be heated while this control is in operation.

For summer use, however, where the fan 21 is to be used for ventilating, suitable electric circuits are provided for short circuiting the switch 23 to permit operation of the fan 21 regardless of the furnace temperature.

The switch 24 is of the type which opens its circuit when a predetermined temperature has been exceeded. This temperature is so chosen that the circuit within the switch is opened when the furnace has been heated to such a point that further heating might prove dangerous. When the circuit is so opened, the damper control operates to check the fire independently of the temperature of the thermostat 18 while the fan motor 22 continues under the control of said thermostat. The fan motor, therefore, continues to operate even though the furnace is overheated so long as the room temperature is not above the degree for which the thermostat 18 is set. The fan 21 thus serves to assist in the cooling of the furnace when the fire has been checked because of overheating.

In Figure 2, the invention is shown applied to a stoker-fired furnace. In the said figure reference numerals refer to parts having similar construction and function to like numbered parts in Figure 1. In addition, there is shown a stoker hopper 34, a stoker motor 35 and fan 36. The fan is driven by the motor 35 and supplies air to the furnace for combustion through a conduit 37. Fuel is supplied from the hopper 34 through a conduit 38 containing suitable conveying apparatus also driven by motor 35. The supply of air and of fuel are, therefore, both accomplished by the operation of the motor 35. Thus combustion within the furnace is accelerated when the motor 35 is operated, and is checked when the motor 35 is stopped. The motor 35 is connected in the wiring in a position corresponding to that of the damper controller 19 and the control of combustion therefor is accomplished in exactly the same manner as with the hand-fired furnace.

By similarly applying the above-described apparatus to the fuel supply system of an oil or gas-fired furnace, the same may be controlled in exactly the same manner. Other variations in the details of the invention are possible without departing from the broader features thereof. For example, the wiring shown herein is the so-called "two wire system". With several commercial types of damper controllers and thermostats, a "three wire system" is used. Such controllers and thermostats may be used as a part of the apparatus for carrying out the invention and the same may be connected by wiring analogous to that shown herein. In another form of the invention, the fan 21 may be so placed as to draw the heated air from the furnace instead of forcing cold air thereto. In either case the rate of cold air supply is controlled by the operation of the fan.

The invention claimed is:

1. In a furnace control, the combination of apparatus for controlling the rate of combustion and the rate of supply of a heat-conducting medium, thermostatic apparatus responsive to furnace temperature, and connections between said control apparatus and said thermostatic apparatus by means of which said control apparatus operates to check combustion while supplying said medium when furnace temperature exceeds a predetermined degree.

2. In a furnace control, the combination of apparatus for controlling the rate of combustion and the rate of supply of a heat-conducting medium, thermostatic apparatus responsive to furnace temperature, and connections between said control apparatus and said thermostatic apparatus by means of which said control apparatus operates to accelerate combustion and check the supply of said medium when furnace temperature is below a predetermined degree.

3. In a furnace control, the combination of apparatus for controlling the rate of combustion and the rate of supply of a heat-conducting medium, thermostatic apparatus responsive to furnace temperature, and connections between said control apparatus and said thermostatic apparatus by means of which said control apparatus operates to check combustion while supplying said medium when furnace temperature exceeds a predetermined degree and to accelerate combustion and check the supply of said medium when furnace temperature is below a second predetermined degree lower than said first.

4. In a furnace control, the combination of apparatus for controlling the rate of combustion and the rate of supply of a heat-conducting medium, thermostatic apparatus responsive to furnace temperature, connections between said control apparatus and said thermostatic apparatus by means of which said control apparatus operates to check combustion while supplying said medium when furnace temperature exceeds a predetermined degree, other thermostatic apparatus responsive to the temperature of the object to be heated, and connections between said control apparatus and said last-mentioned thermostatic apparatus by means of which said control apparatus operates to check both combustion and the supply of said medium when said object is above a predetermined temperature irrespective of the furnace temperature.

5. In a furnace control, the combination of apparatus for controlling the rate of combustion and the rate of supply of a heat-conducting medium, thermostatic apparatus responsive to furnace temperature, connections between said control apparatus and said thermostatic apparatus by means of which said control apparatus operates to accelerate combustion and check the supply of said medium

when furnace temperature is below a predetermined degree, other thermostatic apparatus responsive to the temperature of the object to be heated, and connections between said control apparatus and said last-mentioned thermostatic apparatus by means of which said control apparatus operates to check both combustion and the supply of said medium when said object is above a predetermined temperature irrespective of the furnace temperature.

6. In a furnace control, the combination of an electrically-operated combustion control apparatus adapted to accelerate combustion when supplied with electric power and to check combustion when not so supplied, a motor-driven fan for controlling the supply of air to be heated, a source of electric power, electric circuits for connecting said power source to said control apparatus and the motor of said fan, and thermostatic apparatus interposed in said circuits, responsive to furnace temperature and adapted to interrupt the circuit to said combustion control apparatus while completing the circuit to the motor of said fan when furnace temperature is above a predetermined degree.

7. In a furnace control, the combination of an electrically-operated combustion control apparatus adapted to accelerate combustion when supplied with electric power and to check combustion when not so supplied, a motor-driven fan for controlling the supply of air to be heated, a source of electric power, electric circuits for connecting said power source to said control apparatus and the motor of said fan, and thermostatic apparatus interposed in said circuits, responsive to furnace temperature and adapted to interrupt the circuit to the motor of said fan while completing the circuit to said combustion control apparatus when furnace temperature is below a predetermined degree.

8. In a furnace control, the combination of an electrically-operated combustion control apparatus adapted to accelerate combustion when supplied with electric power and to check combustion when not so supplied, a motor-driven fan for controlling the supply of air to be heated, a source of electric power, electric circuits for connecting said power source to said control apparatus and the motor of said fan, and thermostatic apparatus interposed in said circuits, responsive to furnace temperature and adapted to interrupt the circuit to said combustion control apparatus while completing the circuit to the motor of said fan when furnace temperature is above a predetermined degree, and to interrupt the circuit to the motor of said fan while completing the circuit to said combustion control apparatus when furnace temperature is below a second predetermined degree lower than said first.

9. In a furnace control, the combination of an electrically-operated combustion control apparatus adapted to accelerate combustion when supplied with electric power and to check combustion when not so supplied, a motor-driven fan for controlling the supply of air to be heated, a source of electric power, electric circuits for connecting said power source to said control apparatus and the motor of said fan, thermostatic apparatus interposed in said circuits, responsive to furnace temperature and adapted to interrupt the circuit to said combustion control apparatus while completing the circuit to the motor of said fan when furnace temperature is above a predetermined degree, and other thermostatic apparatus interposed in said circuits in series connection with said first-mentioned thermostatic apparatus, responsive to the temperature of the space to be heated and adapted to interrupt the circuits to both said combustion control apparatus and to the motor of said fan when said last-mentioned temperature is above a predetermined value.

10. In a furnace control, the combination of an electrically-operated combustion control apparatus adapted to accelerate combustion when supplied with electric power and to check combustion when not so supplied, a motor-driven fan for controlling the supply of air to be heated, a source of electric power, electric circuits for connecting said power source to said control apparatus and the motor of said fan, thermostatic apparatus interposed in said circuits, responsive to furnace temperature and adapted to interrupt the circuit to the motor of said fan while completing the circuit to said combustion control apparatus when furnace temperature is below a predetermined degree, and other thermostatic apparatus interposed in said circuits in series connection with said first-mentioned thermostatic apparatus, responsive to the temperature of the space to be heated and adapted to interrupt the circuits to both said combustion control apparatus and to the motor of said fan when said last-mentioned temperature is above a predetermined value.

In witness whereof, I have hereunto affixed my signature.

EDWARD E. FREEMAN.

1104

MERCOID EXHIBIT XXX 8

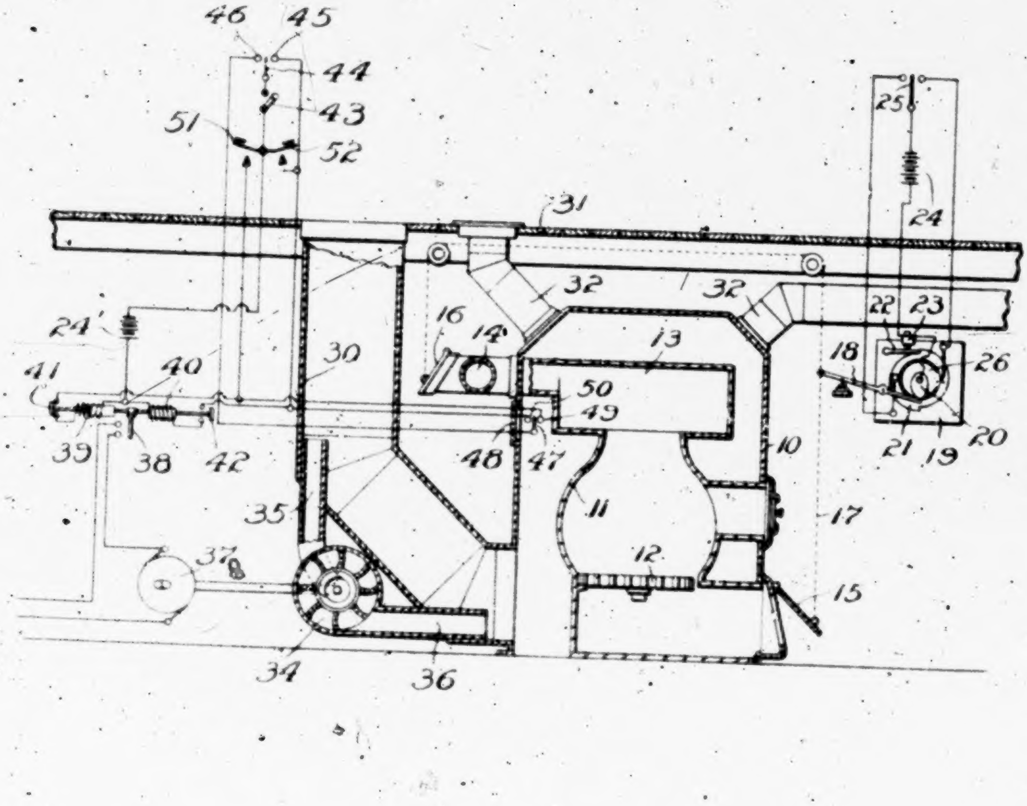
Jan. 23, 1923.

E. F. EDGECOMBE, JR

CIRCULATION CONTROL SYSTEM

ORIGINAL FILED MAY 11, 1915

Re. 15,531



INVENTOR

Edward F. Edgecombe, Jr.

BY

Arthur M. Hood

ATTORNEY

Reissued Jan. 23, 1923. Re. 15,531

UNITED STATES PATENT OFFICE.

EDWARD F. EDGECOMBE, JR., OF INDIANAPOLIS, INDIANA, ASSIGNOR TO THE HONEYWELL HEATING SPECIALTIES COMPANY, OF WABASH, INDIANA, A CORPORATION OF INDIANA.

CIRCULATION-CONTROL SYSTEM.

Original No. 1,138,854, dated May 11, 1915, Serial No. 739,668, filed January 2, 1913. Application for reissue filed July 14, 1922. Serial No. 575,067.

To all whom it may concern:

Be it known that I, EDWARD F. EDGECOMBE, Jr., a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented a new and useful Circulation-Control System, of which the following is a specification.

In hot air heating systems the circulation of the air is frequently poor, in spite of the circulating tendency of the heating source, such as a furnace. This poor circulation may be due, for instance, to the direction of the wind. When the circulation of the heating air is poor, the temperature of the house or other space to be heated becomes uneven in different parts and cannot be maintained as high as desired, even though a good furnace fire is maintained. This results in a waste of fuel and a rapid deterioration of the furnace, not to mention the physical and psychical effect on the inhabitants of the house.

It is the primary object of my invention to improve this circulation when it is poor; and at the same time and thereby to maintain the temperature more nearly even and at the desired point; to economize in fuel; to lengthen the life of the furnace; and to reduce the care required for the operation of the furnace. In attaining these results, I provide means for producing a forced circulation of the heating air, and control such circulating means by the temperature of the furnace; by the temperature at a control point, as in the living room of a house; and, also, for the best results, I combine the circulation control device with means for automatically controlling the furnace drafts.

The single figure of the accompanying drawing illustrates semi-diagrammatically a furnace heating system embodying my invention.

In the arrangement shown there is a furnace 10 of any desired type, usually having a fire pot 11 above a grate 12, the products of combustion in the fire pot 11 passing through a radiator casing 13 and a smoke pipe 14 to a suitable chimney. Draft control doors 15 and 16, communicating with the space below the grate 12 and with the smoke pipe 14 respectively, are connected by a chain 17 to the operating lever 18 of any suitable automatic draft control system. In the case illustrated, this system comprises a spring motor 19, the shaft of which carries a cam 20 which rocks the lever 18 to open and close the furnace draft, the spring motor being provided with a ratchet wheel 21 which cooperates with a pawl 22 to prevent movement of the spring motor save when such pawl is lifted by an electro-magnet 23, which is energized from a battery 24 and controlled by the usual thermostat 25 in the living room or at some other control point and by a commutator 26 on the shaft of the motor 19 to permit a movement of such shaft to put on or shut off the furnace draft when the temperature at the control point reaches the predetermined minimum or maximum. Various forms of damper control schemes may be used, or in some instances none may be used, though the circulation control system hereinafter described works more advantageously when combined with a draft control system.

The air for heating is supplied to the furnace through a pipe 30, which may lead from any desired point, such as the outside atmosphere or from above the floor 31, the furnace ordinarily being located in the cellar. The air from the pipe 30 enters the furnace casing near the bottom, and passes upwardly around the fire pot 11 and radiator casing 13 to the top of the furnace, and thence out through the flues 32 to the rooms or other spaces to be heated. Under many conditions, the circulation of the air is maintained by the heat within the fire pot 11 and radiator casing 13. It is to assist this circulation when it is poor that I have provided my circulation control system. A blower 34, here a centrifugal fan, is suitably pneumatically connected to do this, in the case shown having its inlet pipe 35 opening upwardly into the pipe 30 and the discharge pipe 36 discharging into the furnace so that when the fan is operating it not only blows air out through the pipe 36 but by an injector action increases the flow through the pipe 30 in a shunt path to the blower. The blower 34 is driven by an electric motor 37, of any suitable type though here shown as a direct current motor. The circuit of the motor 37 is controlled by an electro-magnetically operated switch 38 having closing and opening coils 39 and 40, the circuits of

which are broken automatically by auxiliary switch contacts 41 and 42 when such coils have respectively operated the switch. A battery 24′ which for convenience of illustration is shown as separate from the battery 24, though such is not necessarily the case, has one terminal connected in common to the coils 39 and 40, the other terminal being connected through a switch 43 to the movable member or tongue 44 of a thermostat located at the desired control point, such as the living room of the house. This thermostat has the usual "hot" and "cold" contact buttons 45 and 46. The "hot" button is connected through the auxiliary switch 42 to the opening coil 40 of the switch 38. The "cold" button 46 is connected to the movable member or tongue 47 of a thermostat located so that it is responsive directly to the heat of the furnace, conveniently by being mounted on a removable plate 48 so that it is within the furnace casing and in close proximity to the radiator casing 13. This thermostat also has "hot" and "cold" buttons 49 and 50, which are connected through the switches 41 and 42 to the closing and opening coils 39 and 40 respectively of the switch 38. The movable thermostat members 25 and 44 are here shown as separate members, for simplicity of illustration.

In operation, the thermostat 44 is preferably adjusted so that it engages its "hot" and "cold" contact buttons 45 and 46 at temperatures respectively very slightly above temperatures at which the thermostat 25 engages its "hot" and "cold" contact buttons, though other adjustments may be made. When the temperature in the house living room or other control point drops below the predetermined normal value, the thermostat 44 engages its "cold" contact button 46, and if the furnace is hot enough so that its thermostat 47 engages its "hot" contact button 49 at this time, this completes the circuit through the auxiliary switch 41 of the closing coil 39 of the switch 38 and starts the blower in operation to produce a forced circulation of the heating air. However, if the furnace is not sufficiently hot to make the thermostat 47 engage its "hot" contact button, the switch 38 is not closed, and the temperature in the living room may continue to fall until the thermostat 25 closes the circuit for the magnet 23 to raise the pawl 22 to allow the spring motor 19 to rock the arm 18 to open the furnace draft. If the fireman has been faithful, this opening of the drafts produces an increase in the furnace temperature, which, unless conditions are adverse, produces the desired circulation of the air through the pipe 30 and flue 32 to raise the room temperature. However, if conditions are adverse, the circulation thus produced by the increased heat of the furnace is not sufficient, and because of the lack of circulation the temperature of the furnace rises until the thermostat 47 engages its "hot" button 49. The thermostat 44 still being in engagement with its "cold" contact button 46, this closes the circuit through the auxiliary switch 41, for the closing coil 39 of the switch 38, thereby closing said switch to complete the motor circuit and opening the auxiliary switch 41 to break the circuit of the closing coil 39 after it has done its work. The motor 37 now drives the blower 34 to produce a forced circulation through the pipe 30, the furnace, and the flues 32, thereby enabling the full effect of the increased heat due to the opening of the furnace draft to be obtained. The improved circulation thus produced raises the temperature at the control point and elsewhere throughout the house. When the furnace is cooled sufficiently by this circulation to make the thermostat 47 engage its "cold" contact button 50, the thermostat 44 still being in engagement with its "cold" contact button 46; or when the temperature of the living room or other control point rises sufficiently to make the thermostat 44 engage its "hot" contact button 45; the circuit of the opening coil 40 is closed, through the auxiliary switch 42, thereby causing the opening of the switches 38 and 42 and the breaking of the circuits of both the motor 37 and the opening coil 40. When the temperature in the room reaches the upper temperature limit of the thermostat 25, the latter closes the circuit of the magnet 23 to raise the pawl 22 and allow the motor 19 to cooperate to close the door 15 and open the door 16, thus closing the furnace draft, the commutator 26 at the same time immediately breaking the circuit of the magnet 23.

By maintaining the circulation as above described, a much more even temperature is maintained throughout the house; the lifetime of the furnace is lengthened because of the prevention of the excessive heat which is otherwise produced therein; fuel is saved; and the time lag in the draft control system, due to the slowness with which the draft control apparatus responds to changes in the heating effect of the furnace is much reduced.

It will be readily understood that if thermostat 44 be adjusted so that it will remain in contact with the "cold" button 46 even when the room temperatures are as high as may be desired and as may be obtainable with any fire in the furnace, the thermostat 47 will then serve (switch 43 being closed) to automatically control the circulation fan, the fan starting and continuing to run only when the temperature of the furnace is high enough to justify forced circulation, and stopping, and remaining stopped, when, and so long as, the tempera-

ture of the furnace is too low. With this limited portion of the apparatus it is apparent that forced circulation will be avoided whenever the furnace temperatures are too low, and will be established, to assist in preventing the attainment of too high temperatures in the furnace itself, whenever the furnace temperatures are high enough.

The circulation control system may also be used for producing artificial ventilation in summer time. To this end, two push buttons 51 and 52 are provided at some convenient location, as near the thermostat 44, and are connected in common to the wire leading from the battery 24′ to the switch 43. The other terminals of these two push buttons are connected, through the auxiliary switches 41 and 42, to the closing and opening coils respectively, of the switch 38. The switch 43 being open, the motor 37 and blower 34 may be started and stopped as desired by manipulating the push buttons 51 and 52. These push buttons also provide a convenient means whereby when the furnace is going the forced circulation of the heating air may be controlled at will without the aid of the thermostat 44, for, with the switch 43 open, the device is rendered wholly non-automatic and the fan may be started by pressing the push button 51 and stopped by pressing the push button 52.

I claim as my invention:

1. In combination, a hot air heating plant, means for producing a forced circulation for said plant, temperature-responsive means for controlling said circulation producing means, and means responsive to the condition of the heating plant for controlling the effect produced by said temperature-responsive means.

2. In combination, a hot air furnace, a power-operated blower for assisting the circulation of heating air through said furnace, thermostatic means for controlling said blower, and means responsive to the condition of the furnace for controlling the effect produced by said thermostatic means.

3. In combination, a hot air furnace, power-operated means for producing a forced circulation of heating air through said furnace, a thermostat responsive to the temperature at a control point, and a second thermostat responsive to the temperature of the furnace, said two thermostats cooperating to control said circulation-producing means.

4. In combination, a hot air furnace, power-operated means for producing a forced circulation of heating air through said furnace, a thermostat responsive to the temperature at a control point, a second thermostat responsive to the temperature of the furnace, and an electro-magnetically operated device controlling the operation of said circulation-producing means and controlled by the joint action of said two thermostats.

5. In combination, a hot air furnace, power-operated means for producing a forced circulation of heating air therethrough, a thermostat located at a desired control point and having "hot" and "cold" contact buttons, a second thermostat responsive to the temperature of the furnace and also having "hot" and "cold" contact buttons, an electro-magnetically operated device controlling the operation of said circulation-producing means, and connections between said two thermostats and said electro-magnetically operated device whereby the latter is actuated to start the circulation-producing means in operation when the first thermostat engages its "cold" contact button and the second thermostat engages its "hot" contact button, and to stop the operation of the circulation-producing means when both thermostats engage their "cold" contact buttons or the first thermostat engages its "hot" contact button.

6. In combination, a hot air furnace, means for producing a forced circulation of heating air therethrough, temperature-responsive means for controlling said circulation-producing means, and temperature-responsive means for controlling the furnace draft.

7. In combination, a hot air furnace, means for producing a forced circulation of heating air therethrough, means controlled by the temperatures at a desired control point and at the furnace for controlling said circulation-producing means, and means controlled by the temperature at a desired control point for controlling the furnace draft.

8. In combination, a hot air furnace, means for producing a forced circulation of heating air therethrough, and means independently controlled by the temperatures at a desired control point and at the furnace for controlling said circulation-producing means.

9. In combination, a hot air heating plant, means for producing a forced circulation of heating air therethrough, temperature-responsive means for controlling said circulation-producing means, and temperature-responsive means for controlling the heat in said heating plant.

10. In combination, a hot air furnace, means of producing a forced circulation of heating air therethrough, and temperature-responsive means for controlling said circulation-producing means and the furnace draft.

11. In combination, a hot air furnace, means for producing a forced circulation of heating air therethrough, and means controlled by the temperature at a desired con-

trol point for controlling said circulation-producing means and the furnace draft and by the temperature at the furnace for controlling said circulation-producing means.

12. In combination, a hot air heating furnace, means for producing a forced circulation of heating air therethrough, and temperature responsive means, responsive to immediate furnace temperatures, for controlling said circulation-producing means, to automatically start said circulation means upon attainment of a desired furnace temperature and to prevent such movement when the furnace temperature is too low.

13. In combination, a hot air furnace, power-operated means for producing a forced circulation of heating air through said furnace, a thermostat responsive to the temperature of the space to be heated by said furnace, a second thermostat responsive to the temperature of the said furnace, and means through which said two thermostats cooperate to control said circulation-producing means.

14. In combination, a hot air furnace, power-operated means for producing a forced circulation of heating air through said furnace, a thermostat responsive to the temperature of the space to be heated by said furnace, a second thermostat responsive to the temperature of the furnace, and an electro-magnetically operated device controlling the operation of said circulation-producing means and controlled by the inter-dependent action of said two thermostats.

15. In combination, a hot air furnace, means for producing a forced circulation of heating air therethrough, means responsive to the temperature of the space to be heated by said furnace for controlling said circulation-producing means, and means responsive to the temperature of the space to be heated by said furnace for controlling the furnace draft.

16. In combination, a hot air furnace, means for producing a forced circulation of heating air therethrough and means responsive to the temperature of the space to be heated by said furnace for controlling both said circulation-producing means and the furnace draft.

17. In combination, a hot air heating plant, means for producing a forced circulation of heating air therethrough, means responsive to the temperature of the space to be heated by said plant for controlling said circulation-producing means, and means responsive to the temperature of the space to be heated by said plant for controlling the heat in such heating plant.

18. In combination, a hot air heating plant, means for producing a forced circulation of heating air therethrough, and means responsive to the temperature of the space to be heated by said furnace for controlling both said circulation-producing means and the heat in said heating plant.

19. In combination, a hot air furnace, means for producing a forced circulation of heating air therethrough, and means controlled by the temperature of the space to be heated by said furnace for controlling said circulation-producing means and the furnace draft and by the temperature at the furnace for controlling said circulation-producing means.

20. The combination with a hot air furnace, of a forced circulation means for the heating air including a motor, and means for controlling the movement of said motor, comprising a thermostat arranged within the immediate temperature influence of the furnace.

21. The combination with a hot air furnace of a circulation fan arranged to affect the flow of air through the heating spaces of said furnace, an electric motor for driving said fan, and a thermostat arranged within the immediate temperature influence of the furnace for controlling said fan motor to limit its movement to periods during which the furnace is at or above the desired temperature.

In witness whereof, I have hereunto set my hand at Indianapolis, Indiana, this 6th day of July, A. D. one thousand nine hundred and twenty-two.

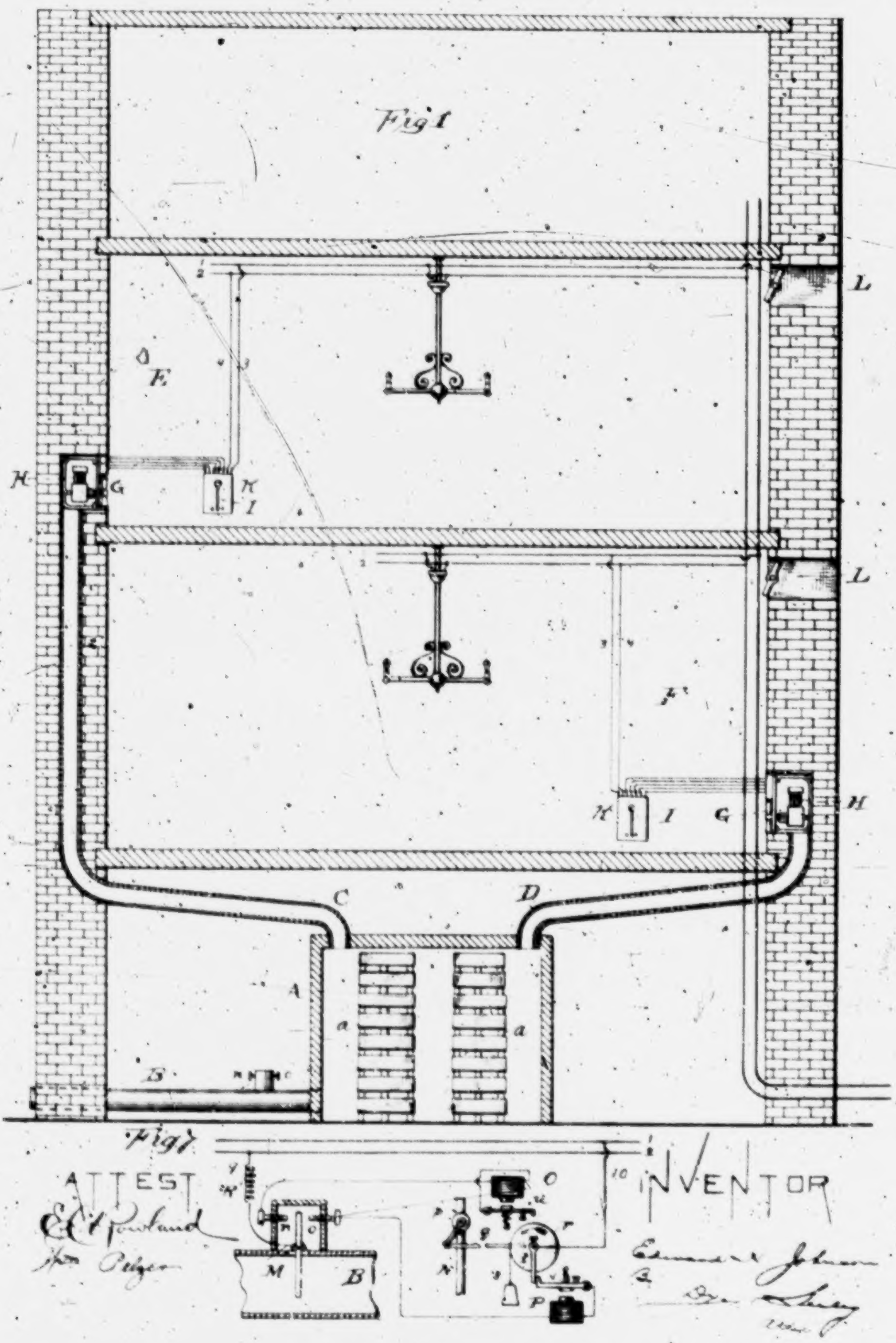
EDWARD F. EDGECOMBE, Jr.

(No Model.) 2 Sheets—Sheet 1.

E. H. JOHNSON.

ELECTRICAL APPARATUS FOR HEATING AND COOLING BUILDINGS.

No. 360,223. Patented Mar. 29, 1887.



No Model.

2 Sheets—Sheet 2

E. H. JOHNSON.

ELECTRICAL APPARATUS FOR HEATING AND COOLING BUILDINGS.

No. 360,223. Patented Mar. 29, 1887.

Fig 2

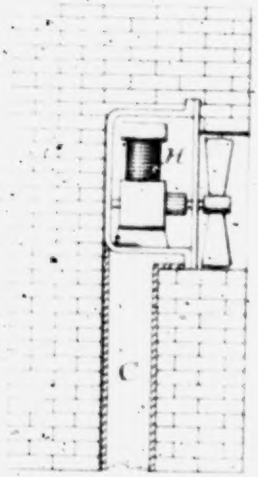


Fig 3

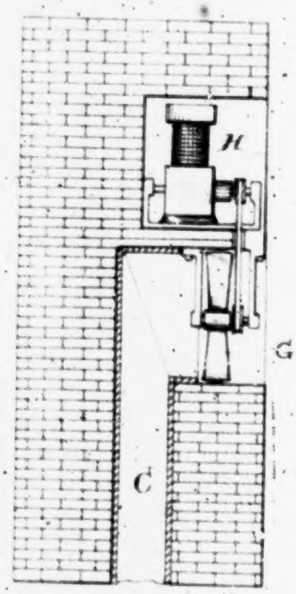


Fig 4

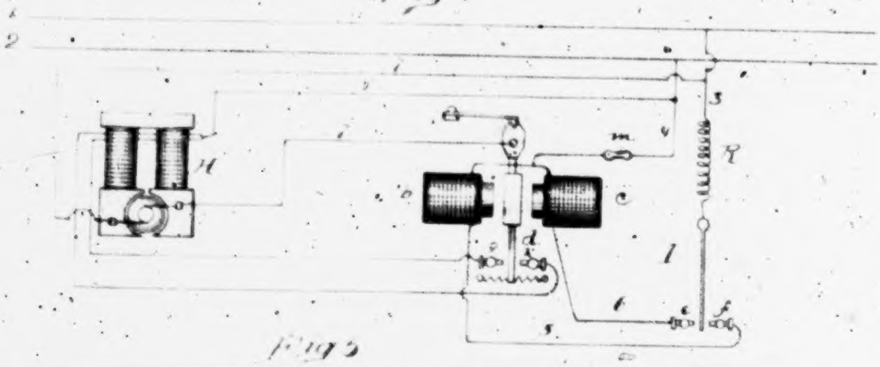
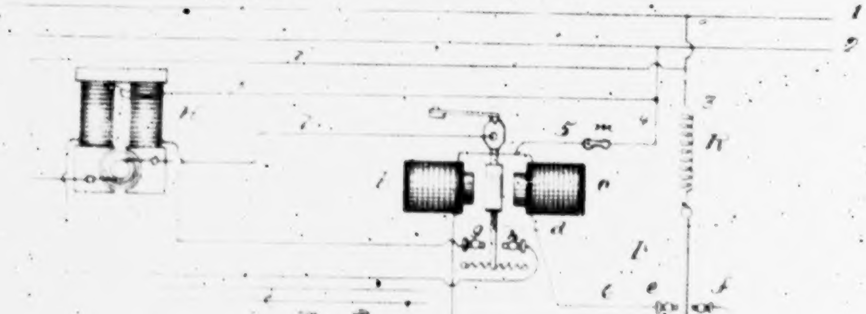


Fig 5



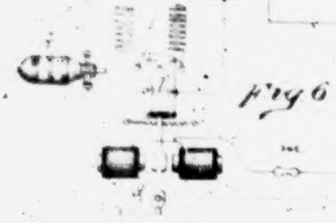


Fig 6

ATTEST

INVENTOR

UNITED STATES PATENT OFFICE.

EDWARD H. JOHNSON, OF NEW YORK, N. Y.

ELECTRICAL APPARATUS FOR HEATING AND COOLING BUILDINGS.

SPECIFICATION forming part of Letters Patent No. 360,223, dated March 29, 1887.

Application filed October 8, 1886. Serial No. 215,651. (No model.)

To all whom it may concern:

Be it known that I, EDWARD H. JOHNSON, of New York city, in the county and State of New York, have invented a certain new and useful Improvement in Apparatus for Heating and Cooling Buildings, of which the following is a specification.

The object I have in view is to produce a simple, efficient, and economical apparatus for automatically maintaining the desired temperature in the rooms of a building. The apparatus is designed to be controlled and operated electrically. It responds independently to changes in temperature in the separate rooms, floors, or other divisions of a building, and it produces a complete circulation of the heated or cooled air from one part of the building to another, so that an excess of heat or cold in one part will be utilized in other parts of the building where the opposite condition exists. It is also designed to be economical in the use of power, to prevent waste when there is an excess of heat or cold.

In carrying out the invention I use the ordinary piping extending from the several rooms of a building to a heating or cooling chamber in the cellar, which chamber is in turn connected by a pipe with the atmosphere outside of the building for supplying fresh air to the heating or cooling chamber, from whence it is delivered to the rooms of the building. At the ends of the air-pipes where they open into the rooms are located revolving fans or blowers capable of movement in opposite directions, so that air may be caused to circulate from the pipes into the rooms or from the rooms into the pipes. Each of these fans is revolved by an electric motor, and the motor is controlled by a thermostat located in the same room.

The rooms may have ventilators connecting with the external atmosphere, or the openings such as exist around windows and doors may be depended upon to supply external air to a room when its fan is drawing air from the room and forcing it down the air-pipes. The thermostat located in the room is adjusted to maintain the temperature within certain limits. Within these limits the motor is at rest; but when either limit is reached the thermostat closes a circuit to intermediate electric apparatus, which closes the motor-circuit and causes the motor to revolve. When the thermostat assumes a central position again, the motor-circuit is broken and the motor stopped. The intermediate electric apparatus reverses the motor, as well as opens and closes its circuit, so that the deflection of the thermostat in opposite directions produces opposite movements of the motor and the fan driven by it. If the building is lighted by electricity, the electric current for operating the motors and their controlling devices may be taken from the electric-lighting circuit at a point beyond the electric-light switches, if any are used, so that the current will be supplied at all times. The air drawn from a room and forced into the air-pipe is returned to the heating or cooling chamber in the cellar, and after being further heated or cooled passes from thence into pipes leading to other rooms of the house, so that the heat or cold already stored up in the air will be utilized. If more air is being forced back into the heating or cooling chamber than is passing therefrom into the rooms of the house, the surplus will be forced out of the fresh-air duct into the external atmosphere.

A simple hand-switch may be provided for each motor to prevent its action when desired.

Advantage is taken of the fact that the air travels in both directions in the fresh-air pipe to provide the apparatus with means for automatically controlling the supply of heat or cold to the radiators in the heating or cooling chamber, so as to prevent waste of power. A swinging vane is introduced into the fresh-air pipe, and by its movements back and forth controls electric circuits, which include devices for controlling the supply of heat or cold to the radiators.

In the accompanying drawings, forming a part hereof, Figure 1 is a sectional elevation of part of a house showing my apparatus applied thereto; Fig. 2, a detail sectional view showing on a larger scale the location of a fan and motor at the end of an air-pipe; Fig. 3, a similar view illustrating the motor separated from the fan and placed above the mouth of the air-pipe. Figs. 4, 5, and 6 are views, principally in diagram, showing the connections of the thermostat, the motor, and the intermediate apparatus; and Fig. 7, a view, partly in diagram, illustrating the devices for controlling the supply of heat or cold to the heating or cooling chamber.

A is a heating or cooling chamber or box

located in the cellar or basement of the building. It is shown as provided with radiators *a*, through which a heating medium—such as steam—or a cooling medium—such as water—may be passed; or this chamber A may be the air-chamber of a hot air furnace. A fresh air pipe or duct, B, leads from the chamber A to a point outside the building. From the chamber A also leads the air pipes or ducts C D, leading to the rooms E F. At the open upper end of each room-pipe is placed a revolving fan, G, which is driven by an electric motor, H, capable of revolving in opposite directions.

The motor may carry the fan directly on its shaft and be located with the fan in the open end of the pipe, as shown in Figs. 1 and 2, or the motor may be in a box above, below, or to one side of the air pipe and be connected with the fan by an endless cord, as shown in Fig. 3.

I is the thermostat, and K is the intermediate apparatus, of which there is one of each for each motor. The intermediate apparatus in Fig. 1 is inclosed in the boxes upon which the thermostats are mounted, and in or upon which the electric connections between the thermostat and the intermediate apparatus are made. In Figs. 4 to 6 such intermediate apparatus is disclosed. It is composed of two electro magnets, *b c*, between which is a pivoted armature lever, *d*, held normally in a central position. The thermostat is located in a circuit, 3 4, from a suitable source of electrical energy. This is preferably the electric lighting circuit 1 2, a resistance, R, being used to reduce the flow of current. At the contacts *e f* of the thermostat the circuit 1 2 is divided into branches 5 and 6, the branch 5 including the magnet *b*, while the branch 6 includes the magnet *c*. In Figs. 4 and 5 the armature lever *d* plays between simple contacts *g h*. From the circuit 3 4, or directly from 1 2, is taken the motor circuit 7 8. Conductor 7 extends to the motor armature and from thence to the pivot of the lever *d*. At the contacts *g h* this circuit is divided, the branches including oppositely wound sections of the motor field-magnet, as in Fig. 4, or one branch including one leg of the field magnet and the other branch the other leg, as in Fig. 5. The conductor 8 extends from the joined ends of the oppositely-wound field magnet sections, Fig. 4, or from the field wire when it passes from one leg to the other of the field-magnet, Fig. 5.

In Fig. 6 the field magnet coils of the motor are shown at *i* and the motor armature at *k*. The lever *d* is shown as working a two-arm reversing device, *l*, reversing the connections of the field magnet coils, and also serving to make and break the entire motor circuit. In all three instances of intermediate apparatus the motor armature and field magnet are located in series in the same circuit, so as to get the advantage of their combined resistance, and the motor is reversed by reversing the polarity of its field magnet. The reversing apparatus also serves to open the motor circuit. The peculiar intermediate apparatus shown in Figs. 4 and 5 possesses the advantage of only requiring the use of simple contact points; but it has the disadvantage as compared with the apparatus of Fig. 6 of not bringing all the wires of the field magnet into circuit at one time.

When a thermostat closes circuit at *e* or *f*, the magnet *b* or *c* is brought into circuit, and closes the motor circuit with such a polarity to the field-magnet that the motor will revolve in one or the other direction, according to whether the thermostat closes on *e* or on *f*. The motor will revolve the fan, which will deliver heated or cooled air to the room or draw air from the room, the loss in the latter case being supplied through a ventilator, L, or through the openings around windows and doors. This operation will continue until the temperature is changed to the necessary extent, when the thermostat will break the circuit to the intermediate apparatus, and this, in turn, will break the motor circuit. The air drawn from one room will be driven back into the heating or cooling chamber, and from thence distributed to other rooms or forced out of the fresh-air duct.

A simple hand-switch, *m*, Figs. 4, 5, and 6, is included in the thermostat-circuit 3 4, so that when desired the apparatus may be made inoperative by breaking the thermostat-circuit. To control the supply of heat or cold to the radiators *a* in the chamber A and prevent waste of power, advantage is taken of the fact that when there is an excess in the supply of heat or cold to the radiators air will be forced out of the fresh-air pipe B, and under the opposite conditions air will be drawn in through said pipe. A swinging vane, M, is introduced into the fresh-air pipe B, Fig. 7. When this vane hangs vertically, it stands centrally between contact points *n o*, and out of contact with such points. The pipe N supplies the heating or cooling medium to the radiators *a*, and is provided with a cock, *p*, which is opened and closed by a pitman-bar, *q*, extending to a wheel, *r*, which wheel is turned by a clock-train, represented by the weight *s*; or any other form of motor can be employed for this purpose. An arm, *t*, on the same shaft as the wheel *r*, is intercepted by the armature levers *u v* of two electro magnets, O P, such armature levers being located at diametrically opposite points, so as to stop the wheel *r* at each half revolution.

From the electric lighting circuit 1 2 is taken the circuit 9 10, which passes to the pivot of vane M and extends in two branches from the contact screws *n o* to the magnets O P, from thence to the armature-levers *u v* of such magnets, and then by a common return from the shaft of wheel *r* to the other side of the circuit 1 2. A resistance, R', may be included in the circuit 9 10, if desired. The cock *p* is shown as open. When the vane M is swung by an

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outflowing current of air, it makes contact at o and closes circuit to the magnet P, which releases the wheel r, and this wheel turns until the arm t is intercepted by the lever u of the magnet O. This half-revolution of the wheel draws the pitman to the other side of the wheel and closes the cock, cutting off the supply of the heating or cooling medium to the radiators a. When the vane swings in the other direction, it will make contact at n and close circuit to the magnet O, when the wheel r will be again released, opening the cock p, and the parts will again assume the position shown. By extending the circuits of the magnets O P through their armature-levers the circuit to each magnet can be completed only when the revolving arm t is in contact with its armature-levers. Hence, each magnet has its circuit broken as soon as it releases the arm t, and a waste of current is prevented. The vane M can be made as sensitive as desired by constructing the part above the pivot of nearly the same weight as the part below the pivot, and by properly proportioning the relative weight of these parts the precise action desired can be secured; or a balanced revolving vane could be used, if desired.

What I claim is—

1. The combination, with an air pipe, duct, or flue delivering air to a room in a building, of a fan or blower located within said pipe, an electric motor operating the same, and a thermostat controlling such motor, substantially as set forth.

2. The combination, with an air pipe, duct, or flue delivering air to a room in a building, of a fan or blower located within said pipe, an electric motor operating the same, an intermediate electric apparatus directly controlling the motor circuit, and a thermostat opening and closing circuit to such intermediate apparatus, substantially as set forth.

3. The combination, with an air pipe, duct, or flue delivering hot or cold air to a room, of a fan or blower located within such pipe and capable of reverse movements, so as to force air into or draw it from the room, and devices controlled by changes in temperature in the room and acting to work such fan or blower in opposite directions, substantially as set forth.

4. The combination, with two or more air pipes, ducts, or flues extending to different rooms of a building, and a common hot or cold air-chamber from which such pipes extend, of a fan or blower located within each of such pipes and capable of reverse movements, so as to force air into or draw it from the room, and devices for each fan controlled by changes in temperature and acting to work such fan or blower in opposite directions, substantially as set forth.

5. The combination, with an air pipe, duct, or flue delivering hot or cold air to a room, of a fan or blower within such pipe capable of movement in opposite directions, an electric motor driving such fan, an intermediate circuit controlling and reversing apparatus for such motor, and a thermostat controlling the circuit to such intermediate apparatus, substantially as set forth.

6. The combination, with the temperature-maintaining fan, of the electric motor driving the same, and having its armature and field-magnet coils in series, an intermediate electric apparatus acting to make and break the motor-circuit and to reverse the connections of its field-magnet coils, and the thermostat controlling the circuit of the intermediate apparatus, substantially as set forth.

7. The combination, with the temperature-maintaining fan, the electric motor, the intermediate apparatus, and the thermostat, of an electric lighting circuit, and connections therefrom to such devices, substantially as set forth.

8. The combination, with the temperature-maintaining fan, the electric motor, the intermediate apparatus, the thermostat, and electric connections for supplying such devices with current for automatic operation, of a hand switch for rendering said devices inoperative, substantially as set forth.

9. The combination, with a heating or cooling chamber, air-pipes leading therefrom to the rooms of the building, and a fresh-air pipe leading to such chamber and having a vane moved by the air currents in such pipe, of means controlled by the air currents in such fresh-air pipe and acting to control the supply of the heating or cooling medium to such chamber, substantially as set forth.

10. The combination, with a heating or cooling chamber, air pipes leading therefrom to the rooms of the building, thermostatically-controlled motors operating fans which act to force air into or draw it from the rooms, and a fresh air pipe leading to such chamber and having a vane moved by the air currents in such pipe, of means controlled by the air currents in such fresh-air pipe and acting to control the supply of the heating or cooling medium to such chamber, substantially as set forth.

11. The combination, with the heating or cooling chamber and the fresh air pipe, of the moving vane in such pipe, a valve controlling the supply of the heating or cooling medium to such chamber, and electric connections controlled by the vane for operating such valve, substantially as set forth.

12. The combination, with the fresh air pipe, the vane therein, and the valve-operating wheel revolved by a motor, of the revolving stop arm, and the two electro magnets having their circuits extending through their armatures and said revolving stop-arm, whereby the circuit of each magnet will be opened after releasing such stop arm, substantially as set forth.

This specification signed and witnessed this 6th day of October, 1886.

EDWD. H. JOHNSON.

Witnesses:

RICHD. N. DYER.

WM. PELZER.

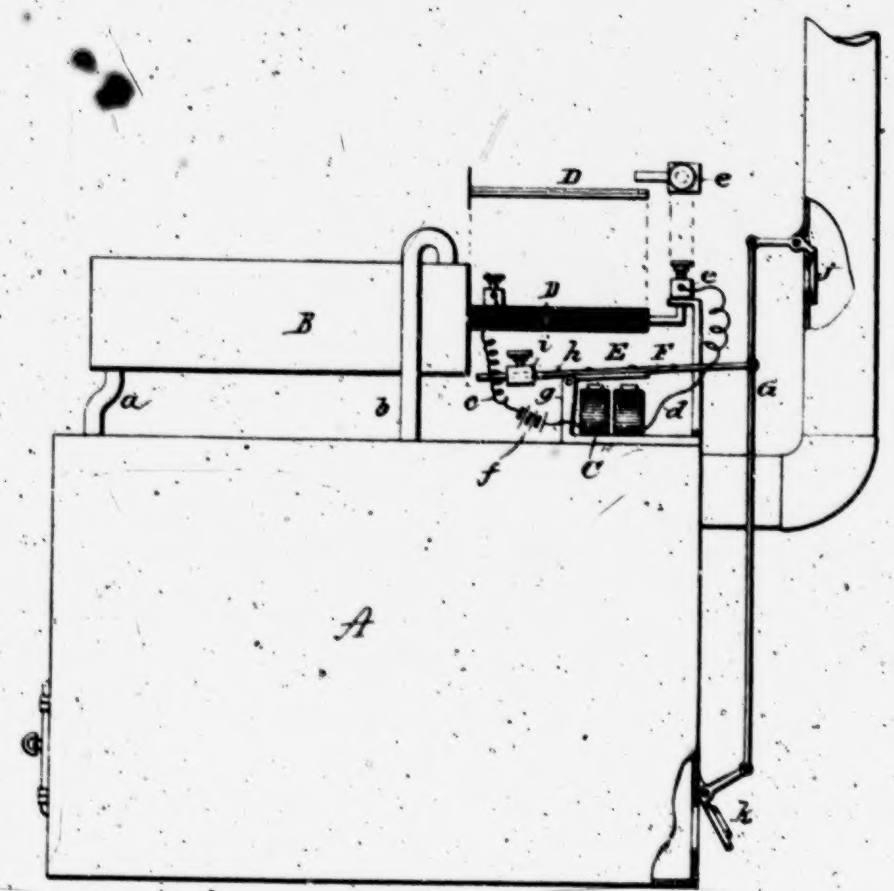
MERCOID EXHIBIT XXX-2

1120 (No Model.)

W. H. KILBOURN.

TEMPERATURE REGULATOR.

No. 479,761. Patented July 26, 1892.



Witnesses

E. S. Nottingham

G. F. Downing

Inventor

W. H. Kilbourn

By Leggett and Leggett

Attorneys

UNITED STATES PATENT OFFICE.

WASHINGTON H. KILBOURN, OF GREENFIELD, MASSACHUSETTS, ASSIGNOR TO ALBERT J. SMART AND J. E. HUBBARD, OF SAME PLACE.

TEMPERATURE-REGULATOR.

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SPECIFICATION forming part of Letters Patent No. 479,761, dated July 26, 1892.

Application filed May 13, 1891. Renewed June 30, 1892. Serial No. 438,635. (No model.)

To all whom it may concern:

Be it known that I, WASHINGTON H. KILBOURN, a resident of Greenfield, in the county of Franklin and State of Massachusetts, have invented certain new and useful Improvements in Temperature-Regulators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an improvement in devices for automatically regulating the temperature, and more particularly to devices for regulating the heat produced by hot-water heaters, the object of the invention being to provide means whereby when a tank or radiator containing hot water becomes too hot the draft to the furnace and the damper in the flue leading from said furnace may be automatically and simultaneously operated to close the former and open the latter.

A further object is to produce a system of devices and electric circuits for the purpose stated which shall be simple in construction and effectual in the performance of their functions.

With these objects in view the invention consists in a thermostat-bar connected with a hot-water radiator, electrical devices connected with said thermostat, and rods connected with said electrical devices for operating valves or dampers.

It further consists in certain novel features of construction and combinations and arrangements of parts, as hereinafter set forth, and pointed out in the claims.

In the accompanying drawing is represented a boiler-furnace having a water-tank or radiator connected thereto and my improved devices for regulating the temperature of the tank or radiator.

A represents a steam-boiler furnace of any preferred construction, and B a water-tank or radiator connected thereto by means of pipes *a b*, whereby a circulation of water will be kept up between the boiler of the furnace and the water-tank B. Located in the tank B and projecting from the end thereof is a thermostat-bar D of any preferred form of construction, to which one end of a conducting-wire *c* is attached, the other end of said wire being connected to one end of the helix of an electro-magnet C. The other end of the helix of the electro-magnet C is connected by a wire *d* with a contact-post *e*, located in proximity to the free end of the thermostat-bar D. A battery *f* may be included in the circuit of the wire *c*, or, if desired, the battery may be included in the circuit of the wire *d*. Pivotally supported over the poles of the magnet C by means of a suitable upright *g* is an armature E for said magnet, and extending across said armature and secured to it is a rod or bar F, the rearward extension *h* of the rod being provided with a weight *i*, whereby to counterbalance the armature. The rod F extends forwardly from the armature and is pivotally connected at its forward end to a vertical rod or bar G. The upper end of the vertical rod or bar G is connected to a normally-closed valve or damper in the pipe or stack *j* of the furnace, while the lower end of said rod or bar G is connected to a normally-open door or damper *k* in the furnace, said door or damper being so located as to control the draft to the fire in the furnace. It is evident that the water-tank or radiator may be located at any desired distance from the furnace, the difference being only in the lengths of the pipes *a b* and conducting-wires *c d*.

Now with the device thus constructed, if the tank or radiator should become too hot, such excessive heat will act upon the thermostat-bar D and cause it to make contact with the contact-post *e*, and thus close the electric circuit (which is normally open) and thereby energize the magnets C to attract their armature E. As the armature E turns on its pivotal connection with the upright *g* the forward end of the rod or bar F will be lowered, carrying with it the vertical rod G. This movement of the vertical bar, it will be seen, opens the damper in the pipe or stack *j* and closes the door or damper *k* of the furnace, thereby causing the temperature of said furnace to be reduced, and consequently causing a reduction of the temperature of the tanks or radiators.

It is evident that the device may be worked on a normally-closed circuit, instead of an open circuit, with slight variations in some of the mechanical details.

Slight changes might be made in the details of construction of my invention without

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departing from the spirit thereof or limiting its scope. Hence I do not wish to limit myself to the precise details of construction above set forth; but,

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with a water-heater and a tank or radiator connected therewith, of a thermostat-bar extending into and projecting beyond the tank or radiator, an electro-magnet, an electric circuit including the thermostat-bar, the electro-magnets and a contact, and dampers connected with the armature of said electro-magnet, so that when the electric circuit is opened or closed by the thermostat-bar one of said dampers will be open and the other closed, substantially as set forth.

2. The combination, with a water-heater and a tank or radiator connected therewith, of a thermostat-bar extending into and beyond the tank or radiator, an electro-magnet, an electric circuit including said electro-magnet, a contact, and the thermostat-bar, a rod or bar secured to the armature of said electro-magnet, a rod connected at a point between its ends to the end of the said rod or bar, and dampers connected to the ends of said rod, substantially as set forth.

3. The combination, with a furnace, a water-tank or radiator, a smoke-pipe, and doors or dampers in the smoke-pipe and furnace, of a thermostat-bar extending into and beyond the tank or radiator, an electro-magnet, an electric circuit including said electro-magnet, a contact, and the thermostat-bar, a rod or bar secured to the armature of the electro-magnet, and a rod connected at a point between its ends to the end of said rod or bar, said rod being connected at one end to the damper of the furnace and at the other end to the damper in the smoke-pipe, substantially as set forth.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

WASHINGTON H. KILBOURN.

Witnesses:

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MERCOID EXHIBIT XXX-5

1124

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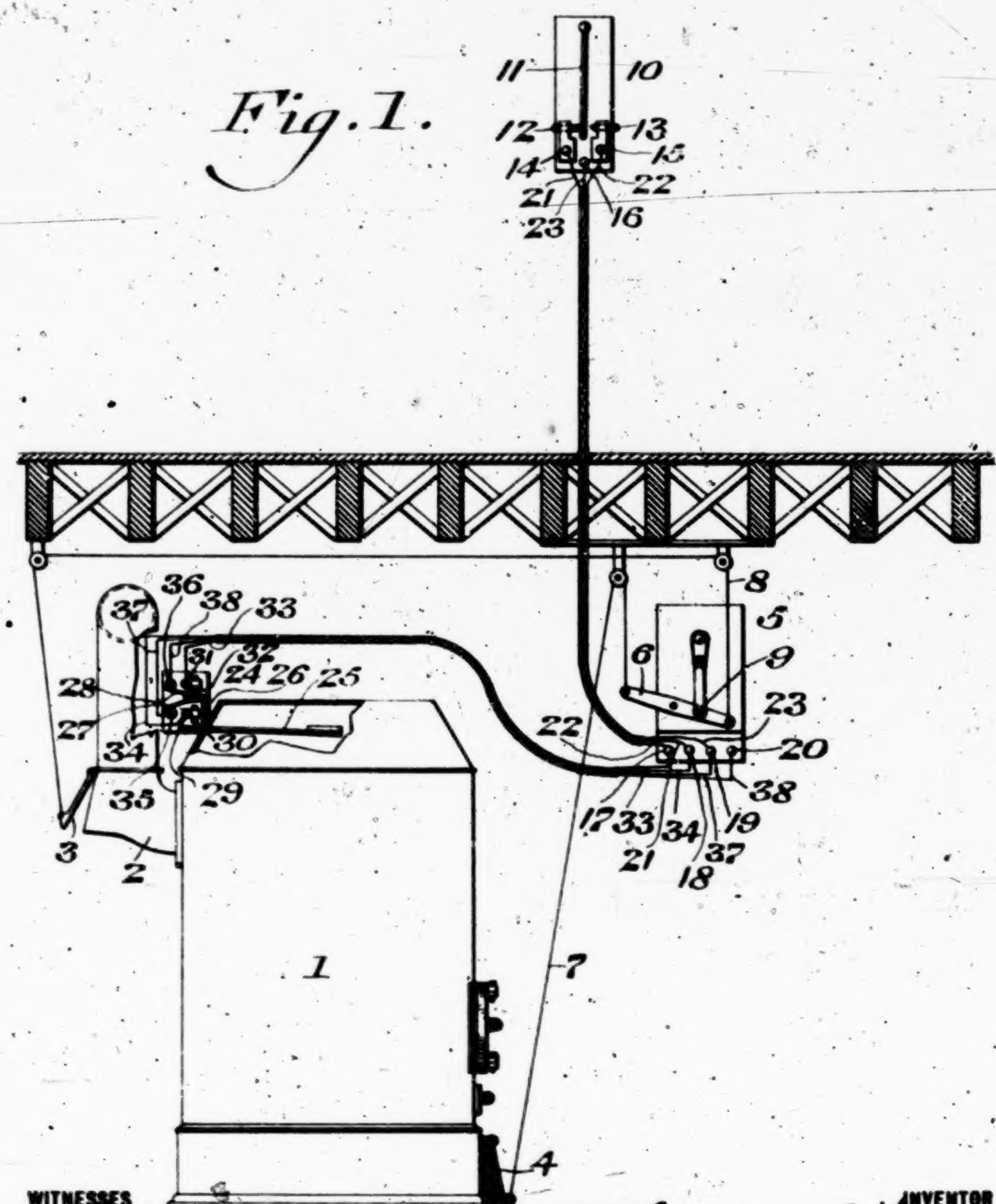
E. R. TEAL, EXECUTRIX.
AUTOMATIC TEMPERATURE REGULATOR.
APPLICATION FILED JULY 22, 1910.

1,067,627. Patented July 15, 1913.

3 SHEETS—SHEET 1.

Fig. 1.



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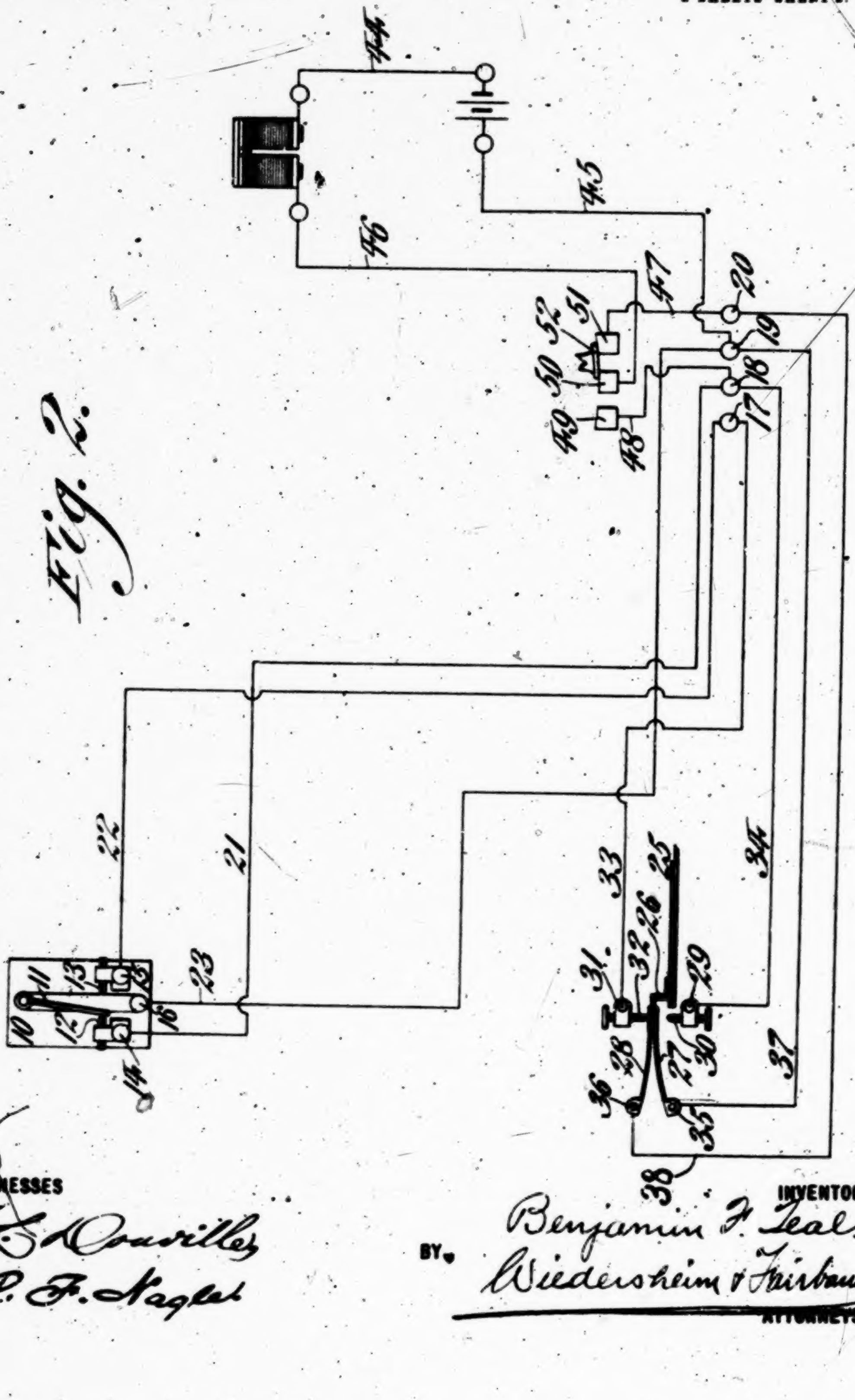
2 SHEETS—SHEET 2.

Fig. 2.



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AUTOMATIC TEMPERATURE-REGULATOR.

1,067,627. Specification of Letters Patent. Patented July 15, 1913.

Application filed July 22, 1910. Serial No. 573,163.

To all whom it may concern:

Be it known that I, BENJAMIN F. TEAL, a citizen of the United States, residing at Glenside, county of Montgomery, State of Pennsylvania, have invented a new and useful Automatic Temperature-Regulator, of which the following is a specification.

My invention relates to new and useful devices for automatically regulating temperatures, in which the controlling action is derived from the source of heat or cold from which the desired temperature is produced. While such a device is capable of a large range of applications in the regulation of both heat and cold, the particular form hereinafter shown and described, is for regulating temperature in the heating of buildings by the ordinary means of hot air, although equally applicable to hot water and steam. In one class of existing devices of this character, the regulation is obtained from a thermostat located in the room to be heated, by which the effects of the maximum and minimum temperature, for which the instrument is adjusted, are electrically transmitted to a suitable mechanism for operating the furnace draft, and thereby regulating the fire so as to maintain the desired temperature in the room. A very serious defect, inherent in this method of regulation, lies in the fact that, so long as the temperature of the room is below the degree for which the thermostat is adjusted, the draft of furnace remains on, and as a consequence, the fire may burn away to a degree which is not only wasteful of fuel, but also, in the case of many furnaces, may become dangerous from overheating of the furnace and of the pipes for conveying the hot air throughout the building. It is obvious, therefore, that economy and safety require that a certain amount of attention and hand regulation be resorted to, to supplement this incomplete automatic action of the device. In another type of apparatus the device is attached to and actuated by the source of heat or temperature changing device: for example, the hot air furnace or the boiler, and controls the fire by operating the furnace drafts independently of the temperature of the room or rooms to be heated. In this case, so long as the temperature is below the maximum degree for which the thermostat is adjusted, the drafts will remain on, although the temperature of the room may be far in excess of the required point. The only remedy for this defect is hand regulation.

The object of my invention is to provide—in combination with a furnace regulation by the temperature of the room—a supplemental control of the heating source or temperature generator by means of its own temperature, and to do this by a method which renders the action of each of the two elements independent for shutting off the furnace drafts, but which makes them interdependent in putting drafts on. The result of the combination is that the respective deficiencies of the two before named systems are provided for in a manner which renders the control absolutely automatic; not only obviating the necessity for hand regulation, but also insuring a reliable temperature (in rooms) for a given adjustment.

In carrying out my invention, I employ a thermostat suitably located in one of the rooms to be heated; a supplemental thermostat located in, or in suitable relation to, the temperature generator; and a suitable means, common to and electrically connected to, both, for operating the furnace drafts.

For the purpose of a clearer description I have designated a thermostat, located in a room to be heated, as the "controller" and a second instrument suitably connected with the hot air chamber or furnace, the "thermostat". The means for actuating the furnace draft is called a "motor" and is common to both controller and thermostat.

In the drawings I have shown a construction for the automatic control of the furnace, which I have found operates successfully in practice, but it will be evident that the arrangement of the parts and application may be varied; other instrumentalities may be employed, and changes may be made in the construction which will come within the scope of my invention, and I do not therefore desire to be limited, in every instance, to the exact form as herein shown and described, since the same is only by way of illustration of the spirit of my invention and I desire to make such changes as may be necessary.

Figure 1 represents a diagrammatic view showing a furnace and the means for automatic regulation of the temperature, in suitable connection therewith. Fig. 2 repre-

sents a diagrammatic view on an enlarged scale, showing the electrical circuits.

Similar numerals of reference indicate corresponding parts in the figures.

Referring to the drawings: 1 designates a furnace suitably located, having a smoke flue 2 controlled by a damper 3 for check draft, and having a damper 4 controlling the air admission or draft to the furnace.

5 designates a motor, suitably situated with respect to the furnace, which is of any suitable or desired construction, and which, in the present instance, is provided with a lever 6 in suitable connection with the operative parts of the motor, one end of which lever is connected with the damper 4 by means of the connection 7; while the opposite end of the lever is suitably connected with the damper 3 for a check draft, by the connection 8, said connections being secured to said lever upon opposite sides of its pivotal point 9.

10 designates a controller which is located at a suitable point in a room or other locality to be heated, said controller being of any suitable or desired construction, and is provided with a thermostatic element 11, one end of which is suitably connected with the controller, and the opposite end is movable between, and is adapted to contact with, one or the other of the two contact points 12 and 13 which are suitably mounted upon the controller 10.

14 designates a binding post in suitable connection with the contact point 12 and 15 designates a binding post in suitable connection with the contact point 13, said controller 10 having a third contact post 16 which is in suitable connection with the battery.

17 designates a connection binding post carried by the motor 5, which latter is also provided with a binding post 18, which is in suitable connection with the operative parts of the motor, in order that when the circuit is closed the motor is actuated to close the drafts, as will be hereinafter set forth.

19 designates a binding post which is in suitable connection with the battery of the motor, and 20 designates a binding post which is in suitable connection with the operative portion of the motor 5, in order that when the circuit is closed the motor is actuated to open the drafts, as will be hereinafter set forth.

21 designates a conductor, connected at one end with the binding post 14 of the controller, and at the opposite end, with the closing draft post 18 of the motor.

22 designates a conductor which is in suitable connection with the binding post 15 of the controller, and which is connected with the connection post 17 of the motor.

23 designates a conductor which is in suitable connection with the battery binding post 16 of the controller and with the battery post 19 of the motor.

24 designates a thermostat, which is suitably located with respect to the furnace, and which is of any suitable or desired construction, and which is provided with a thermostatic element 25 which, in the present instance, extends suitably into and is suitably supported in the furnace 1; said thermostatic element, 25, being provided with or having connected thereto, a member 26, formed of nonconducting material, a suitable portion of which is adapted to be seated between, and preferably in contact with, the two vibrators 27 and 28 which are suitably carried by the thermostat 24.

29 designates a binding post which is in suitable connection with a contact point 30 and 31 designates a binding post in suitable connection with a contact point 32, these parts being suitably mounted and supported by the thermostat 24, it being understood that the contact point 32, in the present instance, is one with which the vibrator 28 will contact when the temperature is such that the draft is on; and the contact point 30 is the one, in the present instance, with which the vibrator 27 will contact in order that the draft will be shut off.

33 designates a conductor which is in suitable connection with the connection post 17 of the motor, and with the binding post 31 of the thermostat 24.

34 designates a conductor which is in suitable connection with the closing draft post 18 of the motor, and with the binding post 29 of the thermostat 24.

35 designates a binding post on the thermostat and in suitable connection to the battery; and 36 designates a binding post also carried by the thermostat, it being noted that the binding post 35 is in suitable connection with the vibrator 27, and that the binding post 36 is in suitable connection with the vibrator 28.

37 designates a conductor which is in suitable connection with the battery post 19 of the motor, and also with the binding post 35 to the thermostat.

38 designates a conductor which is in suitable connection with the opening draft post 20, of the motor 5, and also with the binding post 36, of the thermostat 24.

As will be noted, the contact post 16 of the controller 10 is in suitable connection with the binding post 19 through the medium of the conductor 23 and that said binding post 19 is in suitable connection with the battery through conductor 45, while the said battery is in connection with the magnets through the medium of the conductor 44, said magnets being also connected with the contact point 50 of the motor through the medium of the conductor 46. The binding

post 18 is connected with the contact point 49 of the motor through the conductor 48 while the binding post 20 is connected with the contact point 51 of the motor through the medium of the conductor 47. It will be understood that the said contact points 49, 50 and 51 will be alternately in contact with the contact piece or switch 52 of the motor in order to close the proper circuits. As soon as the movement of the motor occurs through the magnets being energized by the completion of the circuit to the thermostats, the complete movement of the motor will shift the switch 52 from its then position to the opposite position thus opening the circuit previously established and closing it for the next movement of the thermostats. For example, it will be understood that the parts are in the position seen in Fig. 2, the strip 11 has been moved, by the temperature, to contact with the point 12, prior to which contact the contact piece 52 of the motor was in engagement with the contact point 49 and 50 of the motor and the flow of current at that time is as follows:—from the binding post 19, through the conductor 23, through the strip 11, point 12, conductor 21, binding post 18, through conductor 48 to contact point 49, through contact piece 52, contact point 50 and thence through the conductor 46, through the magnets and conductor 44 to the other pole of the battery, this closed circuit energizes the magnets to operate the motor in order to move the contact piece 52 in order that the same will contact both with the contact point 50 and 51 as shown, the circuit through 49 is broken, and at the same time moving the dampers to shut off the draft. Should the strip 27 be in contact with the point 30 the flow of current will now be from the binding post 19 through the conductor 37 through strip 27, point 30 and through conductor 34 to binding post 18 and thence through the magnet to the battery, as previously described, it being understood that the contact piece 52 was then in engagement with the contact points 49 and 50.

The above description will show the absolute independence of the two circuits in closing the dampers to close the draft. To show the interdependence of the circuits to put on the dampers, the following would be the course of the current:—from binding post 19, through conductor 23, through strip 11 and point 13, through conductor 22, binding post 17, through conductor 33 to point 32, through strip 28 and conductor 38 to binding post 20, through conductor 47, through contact point 51, contact piece 52 and contact point 50, through conductor 46 to magnets and conductor 44 to the battery, thus completing the circuit. From this it will be seen if either of the strips 11 or 28 are out of contact with their proper points, the circuit will not be closed and so the dampers cannot be opened to put on the draft.

The operation of the device is as follows: When the parts are in the position seen in the figures it will be noted that the thermostatic element 11, of the controller 10, is in contact with the contact point 12; while the vibrator 28 is in contact with the contact point 32. In this position the draft is off, that is to say, the air damper 4 is closed by reason of the fact that the circuit which actuates the motor for opening the damper, is open, since the current would, when the parts are in this position, pass from the battery post 19, through the conductor 23, to the binding post 16, and through the thermostatic element 11, to the contact point 12, and through the binding post 14, and conductor 21, to the closing binding post 18 on the motor, which would operate the latter to move the lever 6 to a position to close the damper 4 and open the damper 3, by means of the connections 7 and 8. Should, however, the temperature in the room fall below the desired point, the thermostatic element 11 will be actuated or moved, by this, over into contact with the contact point 13, immediately upon which the circuit will be closed in the following manner: from the battery post 19 through the conductor 23 to the binding post 16, thence to the thermostatic element 11, through the contact point 13, through the binding post 15, conductor 22, to post 17, by the conductor 33 to the binding post 31, and thence through the contact point 32, and through the vibrator 28, through the binding post 36, and the conductor 38, to the opening binding post 20, on the motor, which is actuated to open the damper 4, and to close the damper 3, the same remaining in this position until the desired temperature in the room is reached, when the thermostatic element 11 is returned to its position seen in the figures, at which time (except under conditions as hereinafter stated) the motor is operated as previously described, to again close the damper 4 and to again open the damper 3. It will thus be seen that in order to throw on the draft it is necessary for the circuit to pass through the controller and through the thermostat, so that it is necessary that the thermostatic element of both of these parts be in proper position, so that the on-draft circuit is closed, thus the controller and thermostat are interdependent for throwing or putting on the draft.

In some instances it may occur that while the temperature in the room has not been raised to a sufficient point to actuate the thermostatic element 11 to close off the draft, the fire in the furnace would reach a predetermined temperature where it is de-

sirable to check the draft; when this occurs the thermostatic element 25 of the thermostat will be actuated in order to move the vibrator 27 into contact with the contact point 30, thus removing the vibrator 28 from contact with the contact point 32, immediately upon which the circuit will be closed from the battery post 19 through the conductor 37 to the binding post 35, through the vibrator 27, contact point 30, binding post 29, and conductor 34, to the closing binding post 18, of the motor 5, which latter will immediately be actuated to close the damper 4 and open the check draft damper 3 and stop the draft. It will thus be seen that the controller and the thermostat are independent of each other for closing the damper and so shutting off the draft, that is to say, the thermostatic element of the controller, in one position, closes a circuit with the motor for shutting off the draft this being accomplished through the circuit from the battery binding post 19 through conductor 23 and the binding post 16 of the controller through thermostatic element 11, contact point 12, binding post 14, conductor 21, through binding post 18 of the motor which closes the circuit and is operated to close the drafts. The thermostatic element of the thermostat in one position closes a circuit with the motor for shutting off the draft, the circuit in this position being through the battery binding post 19, through conductor 37, binding post 35, vibrator 27 of the thermostat, contact point 30, binding post 29 and conductor 34 to the motor binding post 18 which closes the circuit to close or shut off draft. In this way it will be seen that the controller and the thermostat are independent of each other, through the circuits just described, for closing the damper and so shutting off the draft. To put on the draft, both of the thermostatic elements are in a third circuit with the motor, in order that both thermostats must be in proper position to close the said third circuit to put on the draft, this circuit being as follows: from the battery binding post 19 through the conductor 23, binding post 16, thermostatic element 11 with the contact point 13, against which the element 11 has been moved, through the binding post 15, conductor 22, binding post 17, conductor 33, binding post 31, contact point 32, vibrator 28 of the thermostat, binding post 36, conductor 38 to binding post 20 of the motor which closes the circuit to operate the opening of the draft. From this it will be seen that if either of the thermostatic elements 11 or 28 are out of contact with the respective contact points 13 and 32 the circuit will not be closed, and the draft will not be put on, or, in other words, the controller and the thermostat are interdependent in order to put on the draft.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. In a device of the character stated, a temperature changing device, a controlling means located at a suitable point and adapted to be actuated, depending upon the temperature thereat, a second controlling means situated within said temperature changing device, and subjected directly to the radiant heat and to the products of combustion of the fire without the interposition of a transmitting medium, actuating means in suitable connection with said temperature changing device for controlling the same, and electrical circuits between said first controlling means and actuating means, and between said second controlling means and said actuating means, whereby the actuating means is operated to increase or decrease the action of the temperature changing device, said electrical circuits being interdependent for increasing the action and independent for decreasing the same.

2. In a device of the character stated, a temperature changing device, a controller located at a suitable point and adapted to be actuated, depending upon the temperature thereat, a thermostat situated within said temperature changing device and subjected directly to the radiant heat and to the products of combustion of the fire without the interposition of a transmitting medium, a motor in suitable connection with said temperature changing device for controlling the same, and electrical circuits between said controller and motor, and between said thermostat and motor, whereby the motor is actuated to increase or decrease the action of the temperature changing device, said electrical circuits being interdependent for increasing the action and independent for decreasing the same.

3. In a device of the character stated, a temperature changing device, a controller actuated by the temperature at a desired point, a thermostat situated directly within said temperature changing device and subjected directly to the radiant heat and to the products of combustion of the fire without the interposition of a transmitting medium, a motor in suitable connection with said temperature changing device for controlling the same, an electrical circuit for each movement between said controller and said motor for actuating said motor to decrease the action of said changing device, an electrical circuit for each movement between said thermostat and said motor for actuating said motor to decrease the action of said changing device, and an electrical connection between said controller, said thermostat and said motor to increase the action of said temperature changing device.

4. In a device of the character stated, a

temperature changing device, a motor in suitable connection with said changing device to control the same, a controller having a thermostatic element, an electrical circuit for said controller and said motor, said element in one position closing said circuit to actuate said motor to decrease the action of said changing device, a thermostat having a thermostatic element situated within said temperature changing device and subjected directly to the radiant heat and to the products of combustion of the fire without the interposition of a transmitting medium, an electrical circuit for said thermostat and said motor, said element in one position closing said circuit to actuate the motor to decrease the action of said changing device, and an electrical circuit between said motor, said controller and said thermostat, the last mentioned circuit being controlled by the two thermostatic elements, and said circuit being closed, when said elements are in their other positions, respectively, to actuate the motor to increase the action of the said changing device.

BENJAMIN F. TEAL.

Witnesses:
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1132

MERCOID EXHIBIT XXX-6-

Oct. 5, 1926. 1,602,363

J. C. JOHNSON

ELECTRICAL CONTROL MECHANISM FOR FUEL OIL BURNERS

Filed Jan. 11, 1926

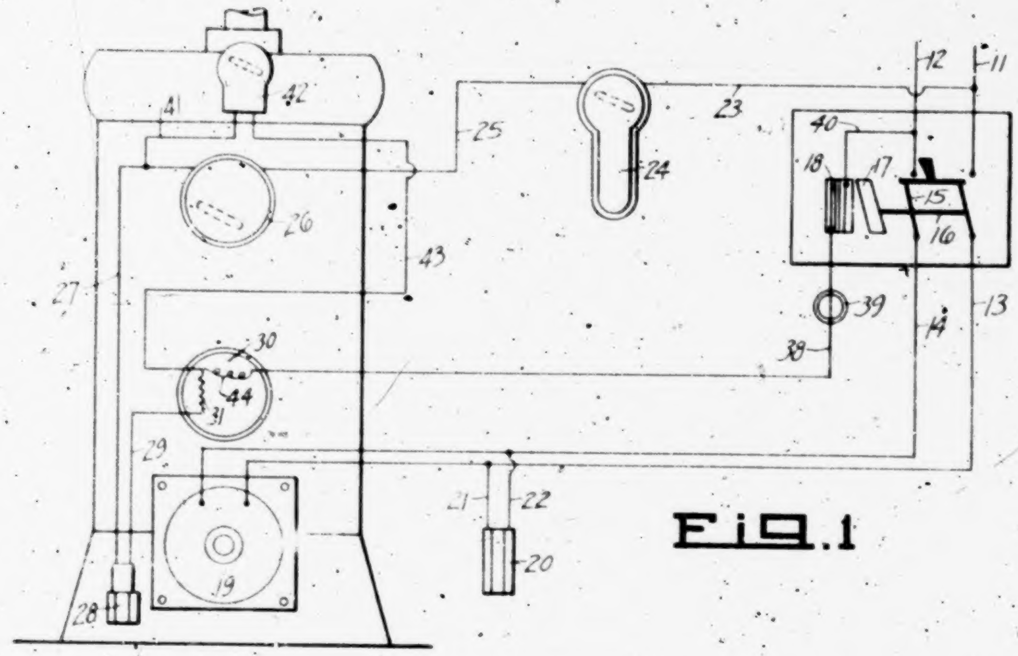

Fig. 1

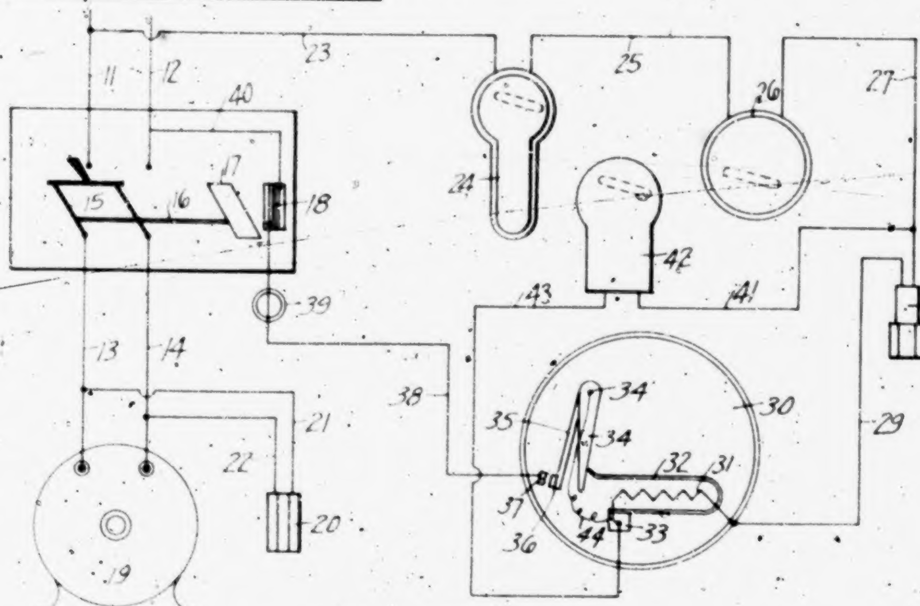

Fig. 2

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JESSE C. JOHNSON

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Patented Oct. 5, 1926. 1,602,363

UNITED STATES PATENT OFFICE.

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ELECTRICAL CONTROL MECHANISM FOR FUEL-OIL BURNERS.

Application filed January 11, 1926. Serial No. 80,659.

This invention relates to an electrical control mechanism for fuel oil burners of the rotary type, in which the operation is initiated or discontinued according to the temperature of the room or other inclosure whose temperature is to be regulated.

While not limited in application, my improved controlling system is more particularly designed for use in dwelling houses and is adapted for application to furnaces which may already be installed therein.

One of the objects of the present invention is the provision of means for controlling the operation of an electric motor which operates the burner and supplies fuel and air for the purpose of combustion, through the medium of a thermostat located in the room whose temperature is to be regulated. This object is effected by merely utilizing the thermostat as a medium for opening the circuit to an electro-magnetic control, operatively associated with the main circuit switch for the motor current.

Another object is the provision of means for controlling an electro-magnetic circuit, operatively associated with the main circuit switch for the motor current, through the medium of a boiler control means, responsive to conditions of temperature within the boiler.

A further object is to automatically stop the motor and the fuel oil supply system of the burner, when the controlling circuit is opened by a manually snap switch button.

Another object is to reduce the gas supply to the pilot frame, after a short interval of time when the burner is ignited.

Another object is to shut down the burner system automatically if the fuel oil supplied to the burner has failed to ignite, or if the fuel oil supply should fail.

Other objects will be made manifest in the following specification of an embodiment of the invention illustrated in the accompanying drawings, in which:

Figure 1 illustrates an oil burning furnace equipped with my improved control mechanism; and

Fig. 2 a diagrammatic view of the electric circuit control mechanism of my invention.

The operating current is obtained from the conductors 11 and 12 to which the service wires 13 and 14 are connected by a double pole single throw main current switch 15. Operatively associated with the main current switch 15, by means of an operating bar 16, is an electro-magnetic control 17 provided with an electro-magnetic coil 18.

The wires 13 and 14 constitute the circuit wires to the burner motor 19. An electro-magnetic fuel oil stop valve 20, interposed in the fuel oil supply line between the source of supply and the burner, is connected in parallel by wires 21 and 22 to wires 13 and 14 respectively, of the motor circuit.

This fuel oil stop valve is preferably controlled by the main circuit switch 15 in the electric circuit that operates the motor, the parts being arranged so that the said valve is held open to permit the flow of oil to the burner so long as the current passes to the motor and is closed to positively shut off the supply of oil to the burner when the motor stops.

A wire 23 extends from the conductor 11 to a room thermostat 24, illustrated diagrammatically, of any well known construction, which remains in a closed position when cold or when the atmosphere at this place is below a certain predetermined temperature, and opens to interrupt the circuit when the atmosphere at this place is above a certain predetermined temperature.

The thermostat 24, is connected in series by wire 25 to a boiler temperature controlled circuit breaker 26, illustrated diagrammatically. This boiler controlled circuit breaker has connection with the steam header of the boiler and is arranged to flex its thermostatic member, when a steam pressure above a predetermined maximum obtains in the boiler to break the circuit.

Connected in series with the boiler temperature controlled circuit breaker 26, by way of wire 27, is an electro-magnetic gas valve 28.

Connected in series with the electro-magnetic gas valve 28, by way of wire 29, is an electrically operated time limit safety control 30. This time limit safety control comprises a heating coil 31, a thermostatic metal member 32, with one end secured at 33 and the other end bearing against a member 34, pivoted at 34′. The metallic member 32 partly surrounds the heating coil 31 and bends away from member 34 when heated. Member 34 is connected through a flexible lead 35, having contactor 36, which is held

against contactor 37, by the end of the thermostatic member 32, to wire 38. Wire 38 leading to the electro-magnetic coil 18 of magnetic control 17.

A manually operated circuit control button snap switch 39 is interposed in wire 38, near or adjacent to the electro-magnetic control 17. A wire 40 leading from the electro-magnetic control to conductor 12.

The series circuit then being complete, leading from conductor 11 by way of wire 23 through thermostat 24, wire 25 to boiler controlled circuit breaker 26, wire 27 to electro-magnetic gas valve 28, wire 29 to time limit safety control 30, wire 38 to electro-magnetic coil 18 and by way of wire 40 to conductor 12.

The shunt out circuit for the electro-magnetic gas valve 28, and to the time limit safety control 30, comprises a branch wire 41, connected to and leading from wire 27 to the fire stack switch 42, a wire 43 extends from the stack switch 42 to the time limit safety control 30 and is connected at 33 with wire 44, said wire 44 forming a shunt circuit between wire 33 and the member 34 of the time limit safety control.

Said shunt circuit being designed to carry its shunted proportion of the current necessary to retain a closed series circuit to the electro-magnetic control, to retain the same in a closed position when the burner is ignited and operating.

This fire stack switch 42 is positioned where its thermostatic member is subjected to the heat from the burner gases. When the burner has been ignited and has burned for a short interval, the thermostatic member of this stack switch will flex to a circuit closing position, thus shunting out the circuit, to the electro-magnetic gas valve 28 and to the heating element 31 of the time limit safety control 30.

The action of the circuits including the operation of my burner control mechanism will now be described.

The closing of the circuit by means of the manually operated current control button snap switch 39 completes the regulating circuit from conductor 11 by way of wire 23 to the thermostat 24, by wire 25 to the boiler control 26, by wire 27 to the electro-magnetic gas valve 28, by wire 29 to the time limit safety control 30, by wire 38 to the electro-magnetic control 17 and by way of wire 40 to conductor 12.

This forms a series control circuit in which the breaking of any of the connections in the circuit would cause the entire circuit to become open and inoperative. This closing of the control circuit by button snap switch 39 energizes the electro-magnetic coil 18 to draw control element 17 into engagement therewith, also closing the double pole single throw main circuit switch 15, operatively associated with element 17 by means of an operating bar 16, thus closing the circuit to the motor. The closing of the motor circuit also operates to energize the electro-magnetic fuel oil valve 20 and a supply of fuel oil to the burner results.

The circuit to the motor is not connected in series with the said series circuit, but directly controlled by this series circuit through the means of the electro-magnetic control 17, operatively associated with the main current switch 15 of the motor circuit. The current supply circuit to the motor is connected in multiple with the said controlling series circuit.

By this arrangement the full current voltage becomes immediately available to operate the motor 19 and the fuel oil stop valve 20, connected in parallel with the motor circuit, uninfluenced by the said series circuit.

This is of considerable importance in this invention.

It has been found in practice to be of great advantage, in overcoming special difficulties in the operation of an oil burning unit controlled electrically, to provide means whereby the motor will operate to its limit capacity immediately after the operating circuit is closed. To include the motor circuit within a series connection, has a tendency to materially reduce the voltage of the current available for use by the motor, resulting in a retarded operation of the motor.

Simultaneously with the closing of the regulating circuit, the electro-magnetic gas valve 28 being energized to open, permitting of a larger flow of gas to the pilot burner to temporarily enlarge the flame thereof. The fuel oil supply issuing from the fuel oil stop valve being ignited by the enlarged flame of the pilot burner and commences heating the furnace.

The heat from the burner gases soon bows the thermostatic member of the stack switch 42, to a closed position, closing the circuit between wires 41 and 43, thus shunting out the circuit by way of wire 27 to the electro-magnetic gas valve 28 and by way of wire 29 to the heating element 31 of the time limit safety control 30. Shunting out the circuit to the electro-magnetic gas valve 28 in this manner causes the gas valve to close, thereby reducing the pilot flame to its normal condition.

The operating control circuit then being complete from conductor 11 by wire 23 to thermostat 24, wire 25 to boiler control 26, from wire 27 by way of wire 41 to stack switch 42, wire 43 to shunt wire 44 and flexible lead 35 to contactors 36 and 37, wire 38 to the magnetic coil 18 and by way of wire 40 to conductor 12.

With the burner now running steadily, assume that an excessive steam pressure is

generated in the boiler, or the room atmosphere reaches a predetermined temperature. This will act upon either, the thermostatic control 24 ~~or on~~ the boiler control 26 to open their respective contacts, thus interrupting the control circuit, de-energizing the electro-magnetic coil 18 of the control 17. This de-energizing of the coil 18 allows the control 17 to fall backwards by its own weight also removing with it the main current switch 15, operatively associated with the same, to an open position thus interrupting the circuit to the motor.

The fuel oil stop valve 20 operates synchronously with the motor, it is opened simultaneously with the operation of the motor and is closed to positively shut off the supply of fuel oil to the burner when the motor stops.

The burner is now shut off. Meanwhile, the thermostatic members of the room thermostat or of the boiler control respectively, are cooling and contracting to the cold point or the closing position, the burner will remain in a shut off condition, until the undesirable conditions in the boiler are corrected, or the temperature of the room has lowered. The gradual lowering of the pressure within the boiler, or a reduced room temperature will eventually complete and close again the control circuits through the thermostat 24 or through the boiler control 26.

This completion of the control circuit will again automatically close the electro-magnetic control 17 including the main current switch to again operate the motor including the fuel oil valve, while at the same time an enlarged flame from the pilot burner will again ignite the fuel oil.

But should there be no ignition of the burner for any reason whatever, as when there is no fuel, or the fuel delivered should fail to be ignited, if for any reason the gas pilot has blown out, there would be no resulting increase in temperature within the furnace and the thermostatic member of the stack switch 42 would receive no heat and consequently would fail to move to a circuit closing position.

The current taken to operate the electro-magnetic control 17 would continue to pass through the time limit safety control 30 and particularly through the heat coil 31. Meanwhile, the metallic member 32 of the time limit safety control 30 being heated by the heat coil 31, bends towards heating coil 31 and frees member 34, thereby interrupting the control circuit between contactors 36 and 37 resulting in de-energizing of the electro-magnetic coil 18 of the control 17 opens switch 15 and stops the burner mechanism. A manual reset is required after thermostatic member 32 has cooled before the circuit can again be closed automatically. This manual reset is effected by means of a push button provided for this purpose, on the exterior of the casing inclosing this device.

I am aware that various forms of thermostatic controls have been used commercially for diverse purposes, and I do not claim these individual controls in detail.

What I claim and desire to secure by Letters Patent is:

1. In an electrical control mechanism for fuel oil burners having, in combination, electric current conductors, a motor for rotating the burner, a circuit connection between the motor and the current conductors, a main circuit switch for the motor, an electro-magnetic control circuit in multiple with the motor circuit operatively connected with said main circuit switch for controlling its operation, an electro-magnetic fuel oil stop valve connected in parallel with the motor circuit, in a series circuit with the said electro-magnetic control a time limit safety control, an electro-magnetic gas valve, a boiler controlled means for opening the circuit to said electro-magnetic control under predetermined boiler conditions so as to substantially de-energize the electro-magnetic control to open the main circuit switch to interrupt the motor circuit and then again under predetermined condition to close said circuit to re-energize said electro-magnetic control to close the main circuit switch to again operate the motor, a temperature actuated stack switch, consisting of a thermostatic member located in the burner stack, arranged to be open when cool and to close when said member is heated, said stack switch being so connected in said series circuit as to shunt out the electric circuit to the electro-magnetic gas valve and to the time limit safety control when the burner is ignited.

2. In an electric control mechanism for fuel oil burners having, in combination, electric current conductors, a motor for rotating the burner, a circuit connection between the motor and the current conductors, a main circuit switch for the motor, an electro-magnetic control circuit in multiple with the motor circuit operatively connected with said main circuit switch for controlling its operation, an electro-magnetic fuel oil stop valve connected in parallel with the motor circuit, in a series circuit with the said electro-magnetic control a time limit safety control, an electro-magnetic gas valve, a boiler controlled means for opening the circuit to said electro-magnetic control under predetermined boiler conditions so as to substantially de-energize the electro-magnetic control to open the main circuit switch to interrupt the motor circuit and then again under predetermined conditions to close said circuit to re-energize said electro-magnetic control to close the main circuit switch to again

operate the motor, a temperature actuated stack switch, consisting of a thermostatic metal member located in the stack, arranged to be open when cool and to close when said member is heated, said stack switch being so connected in said series circuit as to shunt out the electric circuit to the electro-magnetic gas valve when the burner is ignited.

3. In an electrical control mechanism for fuel oil burners having, in combination, electric current conductors, a motor for rotating the burner, a circuit connection between the motor and the current conductors, a main circuit switch for the motor, an electro-magnetic control circuit in multiple with the motor circuit operatively connected with said main circuit switch for controlling its operation, an electro-magnetic fuel oil stop valve connected in parallel with the motor circuit, in a series circuit with the said electro-magnetic control, a time limit safety control, an electro-magnetic gas valve, a boiler controlled means for opening the circuit to said electro-magnetic control under predetermined boiler conditions so as to substantially de-energize the electro-magnetic control to open the main circuit switch to interrupt the motor circuit, and then again under predetermined condition to close said circuit to re-energize said electro-magnetic control to close the main circuit switch to again operate the motor, a temperature actuated stack switch, consisting of a thermostatic metal member located in the burner stack, arranged to be open when cool and to close when said member is heated, said stack switch being so connected in said series circuit as to shunt out the electric circuit to the time limit safety control when the burner is ignited.

4. In an electric control mechanism for fuel oil burners having, in combination, electric current supply conductors, a motor for rotating the burner, a circuit connection between the motor and the current conductors, a main circuit switch for the motor, an electro-magnetic control circuit in multiple with the motor circuit operatively connected with said main circuit switch for controlling its operations, an electro-magnetic fuel oil stop valve connected in parallel with the motor circuit, in a series circuit with the said electro-magnetic control, a time limit safety control, an electro-magnetic gas valve, and thermostatic operated means for controlling the circuit to said electro-magnetic control between desired limits of temperature so as to substantially de-energize the electro-magnetic control to open the main circuit switch to interrupt the motor circuit when the temperature passes the desired limit and then again, when the temperature falls below the desired limit to re-energize said electro-magnetic control to again close the main circuit switch to the motor, a temperature actuated stack switch, consisting of a thermostatic member located in the burner stack, arranged to be open when cool, forming, when closed by heat from the burner a shunt out circuit around the electro-magnetic gas valve and the time limit safety control, so as to shunt out the electro-magnetic gas valve and the time limit safety control when the burner is ignited.

5. In an electrical control mechanism for fuel oil burners having, in combination, electric current supply conductors, a motor for rotating the burner, a circuit connection between the motor and the current conductors, a main circuit switch for the motor, an electro-magnetic control circuit in multiple with the motor circuit operatively connected with said main circuit switch for controlling its operations, an electro-magnetic fuel oil stop valve connected in parallel with the motor circuit, in a series circuit with the said electro-magnetic control a time limit safety control, an electro-magnetic gas valve and thermostatic operated means for controlling the circuit to said electro-magnetic control between desired limits of temperature so as to substantially de-energize the electro-magnetic control to open the main circuit switch to interrupt the motor circuit when the temperature passes the desired limit and then again, when the temperature falls below the desired limit to re-energize said electro-magnetic control to again close the main circuit switch to the motor, a temperature actuated stack switch, arranged to be open when cool, forming, when closed by heat from the burner a shunt circuit around the electro-magnetic gas valve so as to shunt out the electro-magnetic gas valve when the burner is ignited.

6. In an electrical control mechanism for fuel oil burners having, in combination, electric current supply conductors, a motor for rotating the burner, a circuit connection between the motor and the current conductors, a main circuit switch for the motor, an electro-magnetic control circuit in multiple with the motor circuit operatively connected with said main circuit switch for controlling its operations, an electro-magnetic fuel oil stop valve connected in parallel with the motor circuit, in a series circuit with the said electro-magnetic control a time limit safety control, an electro-magnetic gas valve and thermostatic operated means for controlling the circuit to said electro-magnetic control between desired limits of temperature so as to substantially de-energize the electro-magnetic control to open the main circuit switch to interrupt the motor circuit when the temperature passes the desired limit and then again, when the temperature falls below the desired limit to re-energize said electro-magnetic control to again close the main circuit switch to the motor, a temperature actu-

ated stack switch, arranged to open when cool, forming, when closed by heat from the burner a shunt circuit around the time limit safety control so as to shunt out the time limit safety control when the burner is ignited.

7. In an electrical control mechanism for fuel oil burners having, in combination, an electric current supply, a motor for rotating the burner, a circuit connection between the motor and the current supply, a main circuit switch for the motor, an electro-magnetic control circuit in multiple with the motor circuit operatively associated with said main circuit switch for controlling its operation, an electro-magnetic fuel oil stop valve connected in parallel with the motor circuit, in a series circuit with said electro-magnetic control a thermostat for controlling the series circuit to said electro-magnetic control between desired limits of temperature and controlling means responsive to boiler conditions for breaking the circuit between said thermostat and the said electro-magnetic control for rendering the operation of the motor and of the fuel oil stop valve means dependent upon boiler conditions.

8. In an electrical control mechanism for fuel oil burners having, in combination, an electrical current supply, a motor for operating the burner, a circuit connection between the motor and the current supply, a main circuit switch for the motor, an electro-magnetic control circuit in multiple with the motor circuit operatively associated with said main circuit switch to control its operation, an electro-magnetic fuel oil stop valve connected in parallel with the motor circuit, in a series circuit with said electro-magnetic control, controlling means responsive to boiler conditions for opening and closing the circuit to said electro-magnetic control, a thermostat for breaking the circuit between said boiler controlled means and the said electro-magnetic control between desired limits of temperature and for rendering the operation of the motor and of the fuel stop valve dependent upon temperature conditions.

9. In an electrical control mechanism for fuel oil burners having, in combination, electric current conductors, a motor for rotating the burner, an electric circuit connection between the motor and the conductors, a main circuit switch for the motor, an electro-magnetic control circuit in multiple with the motor circuit operatively associated with the main circuit switch to open and close the same, an electro-magnetic fuel oil stop valve connected in parallel with the motor circuit, an electro-magnetic gas valve, an electrically actuated heat coil and a pair of contactors all connected in series with the said electro-magnetic control circuit, a thermostatic metal member in proximity of the heat coil to hold the contactors together when said member is cool, but to permit the contactors to separate and de-energize the heat coil when said member is heated and means for shunting out the electro-magnetic gas valve when the burner is ignited.

10. In an electrical control mechanism for fuel oil burners having, in combination, electric current conductors, a motor for rotating the burner, an electric circuit connection between the motor and the conductors, a main circuit switch for the motor, an electro-magnetic control circuit in multiple with the motor circuit operatively connected with the main circuit switch to open and close the same, an electro-magnetic fuel oil stop valve connected in parallel with the motor circuit, an electro-magnetic gas valve, an electrically actuated heat coil and a pair of contactors, all connected in series with the electro-magnetic control circuit, a thermostatic metal member in proximity to the heat coil to hold the contactors together when said member is cool, but to permit the contactors to separate and break the circuit when said member is heated, to de-energize the electro-magnetic control to open said main circuit switch upon failure of said electro-magnetic gas valve to ignite the burner.

11. In an electrical control mechanism for fuel oil burners having, in combination, electric current conductors, a motor for rotating the burner, an electric circuit connection between the motor and the conductors, a main circuit switch for the motor, an electro-magnetic control circuit in multiple with the motor circuit operatively connected with the main circuit switch to open and close the same, an electro-magnetic fuel oil stop valve connected in parallel with the motor circuit, an electro-magnetic gas valve, an electrically actuated heat coil and a pair of contactors, all connected in series with the electro-magnetic control circuit, a thermostatic metal member in proximity to the heat coil to hold the contactors together when said member is cool, but to permit the contactors to separate and break the circuit when said member is heated to de-energize the electro-magnetic control and open said main circuit switch upon failure of said electro-magnetic fuel oil stop valve to operate, resulting in failure of the burner to ignite.

12. In an electrical control mechanism for fuel oil burners having, in combination, a motor for rotating the burner, an electric circuit connection to said motor, a main circuit switch for said motor, an electro-magnetic control circuit in multiple with the motor circuit operatively connected with said main switch to open and close the same, an electro-magnetic fuel oil stop valve connected in parallel with the motor circuit, in a series circuit with the electro-magnetic control an electro-magnetic gas valve, an elec-

tric heat coil and a pair of contactors having a shunt connection between them, a thermostatic metal member in proximity to the heat coil to hold the contactors together when said member is cool, but to permit the contactors to separate when said member is heated, the shunt connection between the said contactors being designed to carry its shunted proportion of the current necessary to retain the electro-magnetic control circuit in a closed position when the burner is ignited.

In testimony whereof I affix my signature.

JESSE C. JOHNSON.

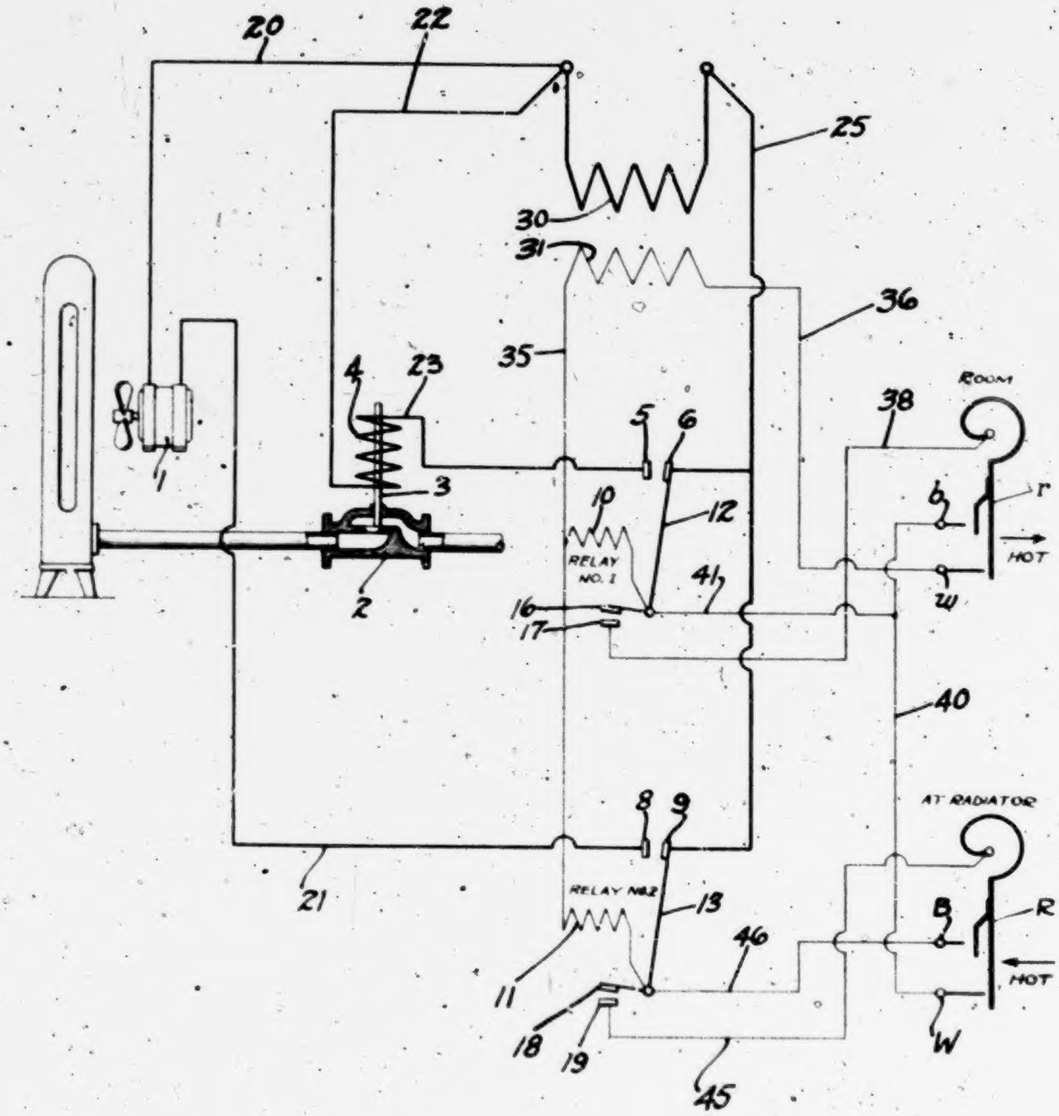
1142

April 10, 1928. 1,665,801

H. W. SWEATT

UNIT HEATER CONTROL

Filed April 27, 1927



Inventor
HAROLD W. SWEATT
By Paul, Paul & Moore
ATTORNEYS

Patented Apr. 10, 1928. 1,665,801

UNITED STATES PATENT OFFICE.

HAROLD W. SWEATT, OF MINNEAPOLIS, MINNESOTA, ASSIGNOR TO MINNEAPOLIS HEAT REGULATOR CO., OF MINNEAPOLIS, MINNESOTA, A CORPORATION OF MINNESOTA.

UNIT-HEATER CONTROL.

Application filed April 27, 1927. Serial No. 187,051.

This invention relates, generally to improvements in heat regulating devices and is particularly directed to the control of the circuit for a power driven fan, which fan is associated with a heating unit, such as a radiator, for the purpose of circulating air, heated by the radiator.

In the usual systems in which the fan of a unit heater is controlled by a room thermostat, it happens that the fan is frequently operated when the radiators or heaters are cold. Inasmuch as these heaters are sometimes arranged adjacent the outer wall of a building and, inasmuch as conduits are often provided so that cold outside air may be delivered to the radiator, operation of the fan when the radiator is cold would result in a cold draft being forced into the building, or the fan would create a cold draft which is also undesirable. Moreover, in hot water systems, or in steam systems in which the drainage is imperfect, it may happen that if the fan starts at a time when there is no heat in a radiator, the water of condensation may be frozen which might result and sometimes does result in cracking of the radiator. Also under these conditions, when thawing takes place, a considerable amount of damage may be done by leaking water.

The main object of the invention is to provide means which will obtain and allow operation of the fan as a result of temperature fluctuations in a room, only when the heater has reached a predetermined temperature. Another object is to provide in conjunction with the above mentioned means, additional means for opening and closing, for example, a radiator valve or equivalent means, for controlling a supply line to the heater and, therefore, heater temperature, accordingly as the heater or heating unit is not or is at the desired temperature.

Features of the invention include the broad idea of controlling the fan of a unit heater in a manner to positively prevent running of the fan when the heater is cold, along with the detailed arrangement of the elements of the apparatus for obtaining the results set forth herein.

The drawing diagrammatically represents the system.

To show one application of the invention, the following construction is illustrated:

The fan motor is indicated at 1 and this motor is supposedly arranged in such relation to a radiator that the fan acts, under normal conditions, to disseminate the heated air. An ordinary type of magnetically controlled valve is shown at 2. 3 is the valve stem and 4 is a coil controlling the valve stem. A relay, sometimes hereinafter referred to as relay No. 1, controls high voltage current to the coil 4 through contacts 5—6. The other relay, hereinafter sometimes referred to as relay No. 2, controls high voltage current to the motor through contacts 8 and 9. The relay coil for relay No. 1 is designated 10 and the relay coil for relay No. 2 is designated 11. The armature for relay No. 1 is designated 12, and the armature for relay No. 2 is designated 13. The armature for relay No. 1 controls current across contacts 16—17, and the armature 13, of relay No. 2, controls the current across the contacts 18—19. When relay No. 1 closes, 5, 6 and 16, 17 make. When relay No. 2 closes, 8, 9 and 18, 19 make.

Conductor 20 connects one side of the motor with the main line and, conductor 21 connects the other side of the motor with contact 8. Conductor 22 connects one side of the main line with one side of the valve coil 4, and conductor 23 connects the other side of the coil with contact 5. Conductor 25 connects the opposite side of the main line with contacts 6 and 9 of the relays. The relay control circuit is operable from the low voltage side of a transformer, the primary side of which is indicated at 30 and the secondary side at 31. One side of the secondary 31 is connected by wire 35 with coils 10 and 11 of the relays. The oppposite side of the secondary 31 is connected by a conductor 36 with contact *w* of the room thermostat, or room device, responsive to control a circuit as a result of temperature fluctuations in a room. The letter *r* represents the bimetallic or other equivalent heat responsive element of a room thermostat. This element is connected by the conductor 38 with the contact 17. The equivalent heat or pressure responsive device such as a hydrostat or pressurestat, located at the radiator, is designated R. and represents a radiator device responsive to control a circuit as a result of temperature fluctuations at the heater. The contacts with which this member cooperates are indicated respectively at W and B. The contacts *b* and W are connected by conductor 40 and, this conductor

is connected with the contact 16 and coil 10 by a conductor 44. Element R of the heater device is connected by conductor 45 with contact 19 and, contact B of the same device is connected by conductor 46 with contact 18 and with coil 11.

Before describing the operation of the device, it is to be known that there are what may be termed three positions of the mechanism. The first may be referred to as the "on" position, in which the room is sufficiently cold, to have obtained opening of the radiator valve, and in which the radiator is sufficiently warm to have obtained a closed circuit to the fan motor. In the "off" position the room is sufficiently warm, the valve is closed, the radiator is sufficiently cold, so that the fan is not running. In the "intermediate" position the room is sufficiently cold, the valve is open, the radiator is cold and the fan will not be running. Thus if the room thermostat closes as a result of a cold room, and if radiator is cold, the fan will stop running, but the valve will be open to furnish heat to the radiator.

It will be noted that in this embodiment of the invention, the room device closes the circuit to the valve when sufficiently cold, while the radiator device closes a circuit to the fan motor when sufficiently hot.

Operation.

Let it be assumed that the apparatus is in "off" position in which the valve is closed and the fan is not running, and both relays are, therefore, open. Under these conditions as the room thermostat cools sufficiently by movement toward the left, relay No. 1 will close when *r—b* make, (first by contacting at *r—w*, and subsequently at *r*, *b*). The result of these contacts is that the valve opens (contact at *r*, *w* are the holding contacts, and are first to close and last to open). When *r*, *b* make, the circuit is also conditioned to allow passage of current for closing relay No. 2 if and when the hydrostat makes at R, B. The result of this contact at R, B, under these conditions is that the motor starts, because there is a call for heat at the radiator. (Contacts R, W, are the holding contacts and are first to close and last to open. The reverse is true of contacts *r*, *b* and R. B, which close last and open first).

In the "on" position two things may happen: (1)—If the room thermostat breaks at *r*, *w*, due to a sufficiently warm room both relays will open or drop out because the room thermostat dominates control of the circuit to the relay coils. When both relays open, the valve closes and the motor stops. (2)—If the radiator cools while the room thermostat is still sufficiently cool, to maintain contact at *r*, *b*, relay No. 2 will open to shut off the motor. When the steam comes on or when the radiator is sufficiently hot, the hydrostat will make first at R, W, then at R, B, relay No. 2 will pull in or close, and the motor will start. While both relays are closed, *r*, *w* and R, W, constitute the holding contacts. It is to be noted that the room thermostat controls both the valve and the motor circuits, or in other words both relays, while the hydrostat controls only the motor circuit, or relay No. 2 and its control of this motor circuit is subordinate to the room thermostat control. Thus the room thermostat controls the valve, and the making of the motor circuit through relay No. 2.

I claim as my invention:

1. In combination a heater and a fan motor there-adjacent, magnetically operable means for controlling the heater temperature, a device responsive to control a circuit as a result of temperature fluctuations at the heater, a device responsive to control a circuit as the result of temperature fluctuations in the room, a first relay controlled by the room device for in turn controlling the magnetically operable means and also for controlling a power circuit to the room device, a second relay controlled by the room device and by the heater device, said second relay in turn controlling the motor and power circuit to the heater device, and circuit connections for the magnetically operable means, motor, relay, and room and radiator devices, arranged to obtain actuation of said magnetically operable means to supply heat when the room is sufficiently cool.

2. In combination a heater and a fan motor there-adjacent, magnetically operable means for controlling the heater temperature, a device responsive to control a circuit as a result of temperature fluctuations at the heater, a device responsive to control a circuit as a result of temperature fluctuations in the room, a first relay controlled by the room device for in turn controlling the magnetically operable means, and also for controlling a power circuit to the room device, a second relay controlled by the room device and by the heater device, said second relay in turn controlling the motor and power circuit to the heater device, and circuit connections for the magnetically operable means, motor, relay, and room and radiator devices, said connections arranged to start the motor only when the heater is sufficiently warm.

3. In combination a heater and a fan motor there-adjacent, magnetically operable means for controlling the heater temperature, a device responsive to control a circuit as a result of temperature fluctuations at the heater, a device responsive to control a circuit as the result of temperature fluctuations in the room, a first relay controlled by the room device for in turn controlling the magnetically operable means and also for con-

trolling a power circuit to the room device, a second relay controlled by the room device and by the heater device, said second relay in turn controlling the motor and power circuit to the heater device, and circuit connections to the magnetically operable means, motor, relay, and room and radiator devices, said connections arranged to obtain actuation of said magnetically operable means to supply heat when the room is sufficiently cool and further arranged to cause the motor to start only when the heater is sufficiently warm.

4. In combination a heater and a fan motor there-adjacent, magnetically operable means for controlling the heater temperature, a device responsive to control a circuit as a result of temperature fluctuations at the heater, a device responsive to control a circuit as the result of temperature fluctuations in the room, a first relay controlled by the room device for in turn controlling the magnetically operable means and also for controlling a power circuit to the room device, a second relay controlled by the room device and by the heater device, said second relay in turn controlling the motor and power circuit to the heater device, and circuit connections for the magnetically operable means, motor, relay and room and radiator devices, said connections arranged to obtain actuation of said magnetically operable means to supply heat when the room is sufficiently cool and further arranged to cause the motor to start only when the heater is sufficiently warm the arrangement further being such that the room device dominates control by the heater device.

In witness whereof, I have hereunto set my hand this 21st day of April, 1927.

HAROLD W. SWEATT.

MERCOID EXHIBIT WW

Oct. 29, 1929. I. E. McCABE 1,734,015

PRESSURE ACTUATED CIRCUIT CONTROL

Filed Feb. 24, 1922

Fig 1

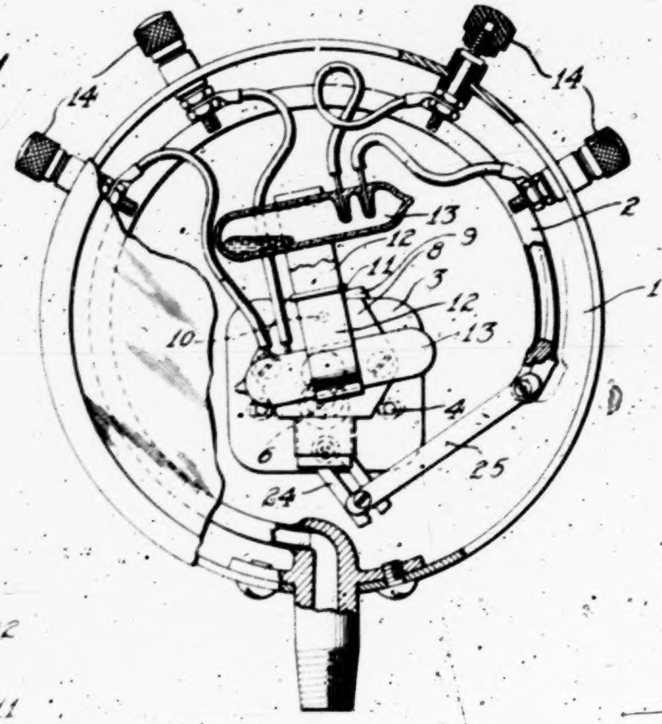
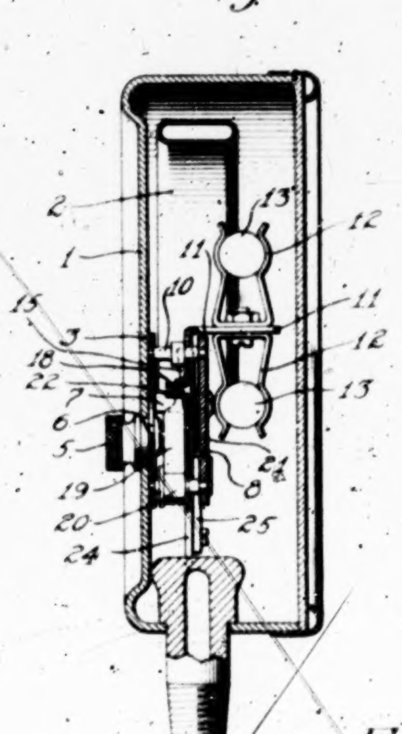


Fig 2



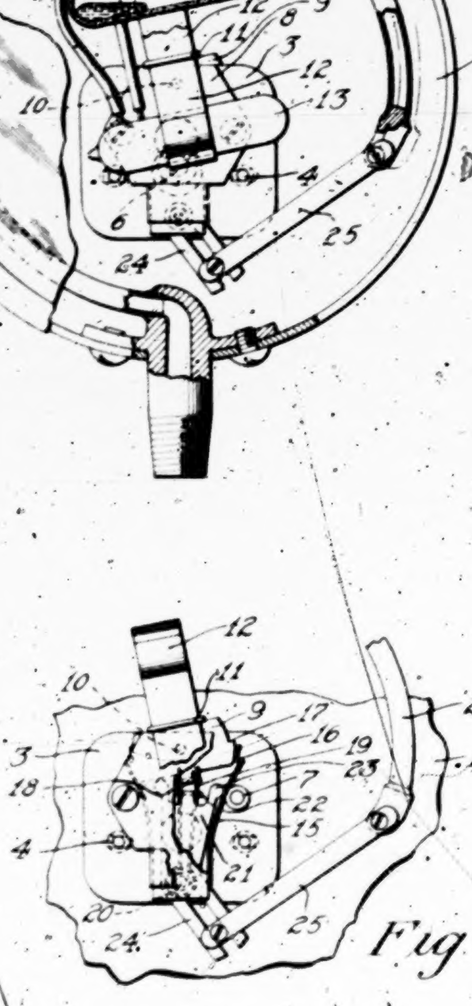
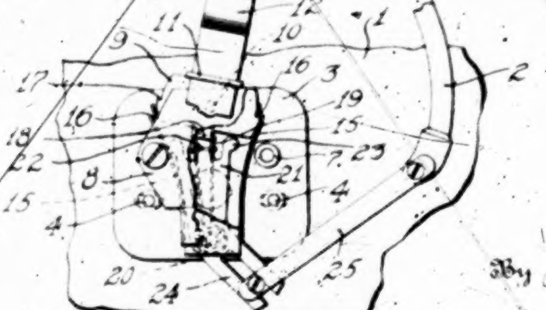


Fig 3

Fig 4



Inventor

Ira E. McCabe

By Langdon Moore

Attorney

Patented Oct. 29, 1929 **1,734,015**

UNITED STATES PATENT OFFICE

IRA E. McCABE, OF CHICAGO, ILLINOIS

PRESSURE-ACTUATED CIRCUIT CONTROL

Application filed February 24, 1922. Serial No. 538,916.

This invention comprises a pressure actuated circuit control. It is in the nature of a continuation and development of the circuit control device shown in my co-pending application filed February 11, 1922, Serial No. 535,755, Patent #1,662,122, issued March 13, 1928.

It is contemplated among the objects of the invention to associate a pressure responsive device and circuit control carrier in such a manner that when a predetermined pressure has been reached, there will be a quick and positive actuation of the circuit control carrier; wherein the carrier and the parts associated therewith will be maintained in set position, unaffected by vibration up to the point where the device is set to be actuated; wherein there is provided a positive locking of the carrier and the circuit control devices associated therewith at the limits of its movement in two directions; wherein initial movement of the pressure responsive device is utilized to store up tension or force for positive actuation of the circuit control carrier and further movement of the pressure responsive device releases the locking instrumentality and permits the utilization of the stored up force to quickly and positively throw the circuit control devices into another position to be locked there until the action is repeated in inverse direction and manner.

Still further objects are the provision of means for simply and accurately accomplishing the setting of the devices to operate at predetermined degrees of pressure and at predetermined times; the housing of the entire working parts within a small, dust-proof and tamper-proof casing in the nature of a gauge and the use of few parts, mechanically associated so as to effectively accomplish the ends intended.

An embodiment of the invention is shown in the accompanying drawing, the following views being shown:

Fig. 1, is a view in front elevation of one embodiment of the invention, certain portions being broken away and parts being shown in section.

Fig. 2, is a view in vertical section through Fig. 1;

Figs. 3 and 4 are detail fragmentary views showing the parts in their two extreme positions.

In the drawing, a casing 1 is provided with means for connecting it to a source of pressure, and associated with such means there is a pressure responsive instrumentality 2, here shown as an ordinary "Bourdon" tube. Its movements under different degrees of pressure are utilized to actuate a circuit controlling instrumentality which will now be described.

Upon an inner wall of the casing there is mounted a base or plate 3. It is provided with elongated slots 4 and screws, disposed in these slots permit the loosening and freeing of the plate for adjustment within the range of the length of the slots. Means are provided for shifting the plate positively and within minute or almost micrometer range, and as here shown a knurled thumbnut 5 has a portion bearing in the casing wall and an eccentric or offset portion 6 connected to the plate. When the screws in the slots have been loosened, turning of the thumbnut shifts the plate from side to side and this shifting movement is utilized to set the instrumentalities now to be described so that they will operate at predetermined times and after a predetermined pressure has been set up in the pressure responsive device. When the desired setting is accomplished the screws are utilized to lock the plate and the devices carried thereby, in set position.

Mounted upon base 3, there are posts or spacers 7 which carry a second plate 8, in spaced relation to the first plate and secured suitably to the posts as by screws. These two plates and their connections constitute a housing and carrier for the moving parts of

the circuit controlling devices and they move as a unit when being adjusted.

Means are provided for carrying circuit controlling devices and for permitting the movement of these devices to effect actuation of the circuit control. As here shown, such means include a circuit controlling, carrying, or actuating device having a body portion 9, mounted for oscillating movement on a stem or shaft 10, which, in turn has bearings in the front and back plates respectively. At one end of the body portion there is an extension, arm, or support 11, arranged in angular relation to the body portion and extending outwardly therefrom. It constitutes a support or carrier for circuit controlling device retainers 12, here shown in the form of clips into the resilient arms of which circuit controlling devices 13 may be slipped and securely retained. As here shown these circuit controlling devices comprise a closed tube within which there are terminals of an electric circuit which is opened or closed by a drop of mercury. As shown in Fig. 1, there are two carriers in the present embodiment the poles of each being at opposite sides of the tubes, that is, one set of terminals will be to the right and the other to the left. These are connected suitably to binding posts 14, to which may be connected any desired instrumentalities which the circuit controlling devices are to govern. A large variety of uses is accommodated by this arrangement, as various forms of circuit controlling devices may be inserted in the carriers, and by arranging the terminals in different positions a large range of uses is possible. In the present embodiment, when the carriers are in the position as shown in Fig. 1, the upper circuit control device is in open position and the lower one is closed. Movement of the carriers in the opposite direction from that shown will effect just the opposite result.

Means are provided for effecting this movement of the carriers under the influence of the pressure responsive device, and for effecting it in a quick and positive manner after a predetermined pressure has been reached. Associated with such means there are means for locking the carriers at the limits of their movement in each direction, for storing up force which is to swing the carriers and for releasing the locking means to permit swinging movement of the carriers.

Upon an extended portion of the top plate 8, are resilient arms 15, the free ends of which bear against opposite sides of the circuit actuating device 9. These arms are provided with hooked portions 16 adapted to engage and securely hold, until forced therefrom, a notched portion 17 in the side of the member 9. The normal pressure of the arms is inwardly, so that at the end of its oscillating movement in either direction, member 9 is locked by the hooked portion 16 on one of the arms engaging notch 17 on the member.

Extending inwardly, at an angle to the body of member 9, there is a second arm or extension 18, and engaging opposite edges of this arm there are resilient members 19, which are mounted on a stem or shaft 20, the latter having a bearing rotatively in the front and back plates. This shaft also carries a combined lever and trip mechanism having a body portion 21, mounted intermediate its ends on stem 20 and capable of being oscillated on this point as a pivot. At one end of body portion 21, there is an inwardly extending arm 22 placed between the free ends of resilient members 19. These resilient members are arranged so that their free ends press towards each other and when arm 22 is moved towards the right in Fig. 4, for instance, pressure will be built up in the left hand resilient member at the point where it engages arm 18 on the circuit actuating member 9 and this force or pressure is utilized to quickly and positively throw member 9 to the limit of its movement, under the exertion of this pressure when the locking means are released. For releasing the locking means, there are oppositely disposed rounded extensions 23 carried by the trip mechanism 21 and placed to engage the inner portion of each resilient arm 15 so as to force the hooked portion 16 of the arm out of notch 17 and permit member 9 to swing under the influence of the pressure or tension built up and existing between arm 18 and spring member 19.

Extending outwardly from the body portion 21 there is a slotted arm 24, coacting with which there is a link 25 which is connected to the free end of the pressure responsive device 2. The connection is effected by an adjustable screw movable in the slot in the arm and provides a secondary means of adjusting the sweep of the pressure responisve device and its action on the circuit controlling devices.

With the parts in the position shown in Fig. 3, movement of the free end of the pressure responsive device to the right, will be communicated to link 25. This will swing member 21 on its pivot and its upper portion will be pressed towards the left. During this movement, right hand resilient member 19 will be exerting pressure against the edge of arm 18 and this will continue until the left hand rounded extension 23 on member 21, engages the inner portion of the left hand spring latch or resilient arm 15, whereupon the latch will be forced from the notch and member 9 will be quickly and forcibly swung towards the right, or to the position shown in Fig. 4. In connection with this movement,

the upper circuit will be closed and the lower one opened as best seen in Fig. 1.

The invention provides a simple and effective means for positively actuating a circuit controlling device especially where there is considerable vibration and where it is desirable to maintain the devices in a fixed position until a predetermined degree of pressure has been reached. While it has been illustrated in the present embodiment, it is understood that I do not wish to be limited to the precise form of this disclosure as many changes in the general structure and arrangement of the parts are considered to be within the scope of the invention as set forth in the claims.

What I claim is:-

1. The combination of a liquid contact circuit controlling device having the contacts thereof enclosed in a sealed tube, a carrier therefor including an arm mounted for oscillatory movement; a rotatable shaft; a spring member operatively associated with the arm and mounted upon said shaft; means for swinging the arm through the medium of the spring member upon rotation of said shaft; means for locking the arm in swung position; said means including a member extending from the arm; a latch operatively associated therewith; means for rotating the shaft for building up resistance between the spring and arm; and means for releasing the latch to allow the built-up resistance to snap the contact tube from the end of movement in one direction to the end of movement in the opposite direction when the resistance has reached a predetermined limit.

2. In a pressure actuated circuit controller, a casing; a plate mounted therein, a liquid contact circuit controlling carrier mounted for oscillatory movement on the plate; a member operatively associated with the carrier and having a portion extending outwardly therefrom; a spring operatively associated with the member; a carrier for the spring rotatively mounted upon said plate; and pressure actuated means for rotating the spring carrier, and through the spring, moving the circuit control carrier.

3. In a pressure actuated circuit controller, a casing; a plate mounted therein, a liquid contact circuit controlling carrier mounted for oscillatory movement on the plate; a member operatively associated with the carrier and having a portion extending outwardly therefrom; a spring operatively associated with the member; a carrier for the spring, rotatively mounted for rotative movement; means for rotating the spring carrier and through the spring, moving the circuit control carrier; said means including a pressure responsive device; and mechanism connecting the pressure responsive device and spring carrier.

4. In a pressure actuated circuit controller, a casing; a plate mounted therein, a liquid contact circuit controlling carrier mounted for oscillatory movement on the plate; a member operatively associated with the carrier and having a portion extending outwardly therefrom; a spring operatively associated with the member; a carrier for the spring, mounted upon said plate for rotative pressure actuated movement; means for rotating the spring carrier and through the spring, moving the circuit control carrier; and means for locking the circuit control carrier in thrown position.

5. In a pressure actuated circuit controller, a casing; a plate mounted therein, a liquid contact circuit controlling carrier mounted for oscillatory movement on the plate; a member operatively associated with the carrier and having a portion extending outwardly therefrom; a spring operatively associated with the member; a carrier for the spring, mounted upon said plate for rotative movement; pressure actuated means for rotating the spring carrier and through the spring, moving the circuit control carrier; means for locking the circuit control carrier in thrown position; and means for releasing the lock.

6. In a pressure actuated circuit controller, a pressure responsive device, a circuit controlling device including a pivoted liquid contact carrier and a rotatable shaft mounting a resilient actuator for the carrier operatively associated with the pressure responsive device, said carrier and shaft mounted upon a support and means for bodily moving the support with relation to the pressure responsive device to effect adjustment of said devices to regulate the operation thereof.

7. In a pressure actuated circuit controller, a casing, a pressure responsive device, a circuit controlling device including a pivoted liquid contact carrier and a rotatable shaft mounting a resilient actuator for the carrier operatively associated with the pressure responsive device, said carrier pivot and shaft carried upon a support mounted for bodily movement upon the casing and means for bodily moving the circuit controlling device in relation to the pressure responsive device including a manually rotatable member mounted on the casing having an eccentric connection to the support.

8. A fluid pressure operated liquid contact snap switch including a pressure responsive device, a liquid contact switch having the terminals enclosed in a sealed tube, a carrier for the contact tube including an arm mounted for oscillating movement, a rotating shaft, a spring member operatively associated with the arm and mounted upon said shaft, means actuated by the pressure responsive device for rotating the shaft and building up tension in the spring, means co-acting with the carrier plate for holding the same at the ends of oscillation as tension is being built up in the

spring and means associated with the spring tensioning means thereafter releasing the carrier plate and subjecting it to the built up tension to snap the contact tube to the other end of the oscillation of the carrier plate.

9. A fluid pressure operated liquid contact snap switch including a pressure responsive device, a liquid contact switch having the terminals enclosed in a sealed tube, means associated therewith actuated by the pressure responsive device to project the contact tube with a positive sudden and continuous movement from one position to another insuring a quick make or break of the switch circuit at each predetermined movement of the pressure responsive device, and additional means for bodily moving the tube projecting means in relation to the pressure responsive device for adjusting the operation thereof to actuate the switch at various predetermined pressures.

10. In combination, a pressure actuated circuit controller comprising a tilting mercury tube switch, a pressure responsive means for tilting said switch, means to maintain said switch in predetermined open or closed positions, and a quick throw mechanism whereby in response to predetermined changes in pressure the switch is tilted from one predetermined position to the other.

11. In combination, a pressure actuated circuit controller comprising pressure responsive actuating means, an enclosed liquid contact opening and closing device, a mounting therefor adapted to assume one or the other of two predetermined positions, and means responsive to predetermined changes in pressure to positively position said mounting in either of said predetermined positions.

12. In combination, a pressure actuated circuit controller comprising pressure responsive actuating means, a tilting enclosed liquid contact opening and closing device, a mounting therefor adapted to assume one or the other of two predetermined positions to open or close the circuit, means responsive to predetermined changes in pressure to positively position said mounting in either of said positions, and means for adjusting the pressures at which such changes in position of the liquid contact device shall occur.

13. In combination, a pressure actuated circuit controller comprising a pressure responsive actuating means, a tilting mercury switch, means for supporting said switch, means for tilting said switch to either predetermined closed or open position, together with means for maintaining said switch in either position until a predetermined change in pressure is reached when it is immediately tilted to the opposite position.

14. A pressure actuated circuit controller comprising a Bourdon tube, a tilting mercury switch, a snap action mechanism mounting said switch and means operatively associated therewith actuated by movement of the Bourdon tube at predetermined pressures to operate the snap action mechanism to tilt the mercury switch from open to closed position and maintain it in that position or vice versa.

15. A pressure actuated circuit controller comprising a Bourdon tube, a tilting mercury switch, a snap action mechanism mounting said switch and means operatively associated therewith actuated by movement of the Bourdon tube at predetermined pressures to operate the snap action mechanism to tilt the mercury switch from open to closed position and maintain it in that position or vice versa, together with means for adjusting the pressures at which the tilting shall occur.

16. In combination, a circuit controller comprising a pressure responsive actuating means, one or more tilting liquid contact switches, a mounting therefor adapted to assume one or the other of two predetermined positions, and mechanism for storing up the energy produced by the changes in pressure of the pressure responsive means and releasing it at predetermined pressures to positively position said switches in either of said two positions in response to predetermined changes in pressure.

17. In combination, a circuit controller comprising a pressure responsive actuating means, one or more tilting liquid contact switches, a mounting therefor adapted to assume one or the other of two predetermined positions, and mechanism for storing up the energy produced by the changes in pressure of the pressure responsive means and releasing it at predetermined pressures to positively position said switches in either of said two positions in response to predetermined changes in pressure, together with means for adjusting the pressures at which such tilting of the said switches shall occur.

18. In combination, a circuit controller comprising a pressure responsive actuating means, one or more fluid contact switches, a mounting therefor tiltable to each of two predetermined positions, means operatively associated with the actuating means for tilting the switches from one position to the other at predetermined pressures to make or break the circuits controlled thereby irrespective of changes from the vertical.

19. In combination, a pressure actuated circuit controller comprising a fluid contact switch, a mounting therefor tiltable to either of two predetermined positions, whereby in one position the circuit is open and in the other the circuit is closed, and means coacting therewith to place the switch in either position in response to predetermined pressures irrespective of such variation from the vertical position of the controller as will normally permit the circuit to remain open or

closed in the switch until tilted by predetermined pressures.

20. In a circuit controller, a pressure responsive actuating member, a tilting fluid contact switch, a mounting therefor tiltable to either of two predetermined positions at a greater tilt than required to operate the switch, and means coacting therewith to place the switch in either position in response to predetermined pressures and permit the circuit controller to be varied from the normal position in proportion to the excess tilt provided and permit within these limits the normal operation of the switch at the predetermined pressures.

In testimony whereof I affix my signature.

IRA E. McCABE.

MERCOID EXHIBIT XXX 3

May 13, 1930. W. M. CROSS 1,758,146

DOMESTIC HEATING SYSTEM

Filed Nov. 11, 1926 3 Sheets-Sheet 1

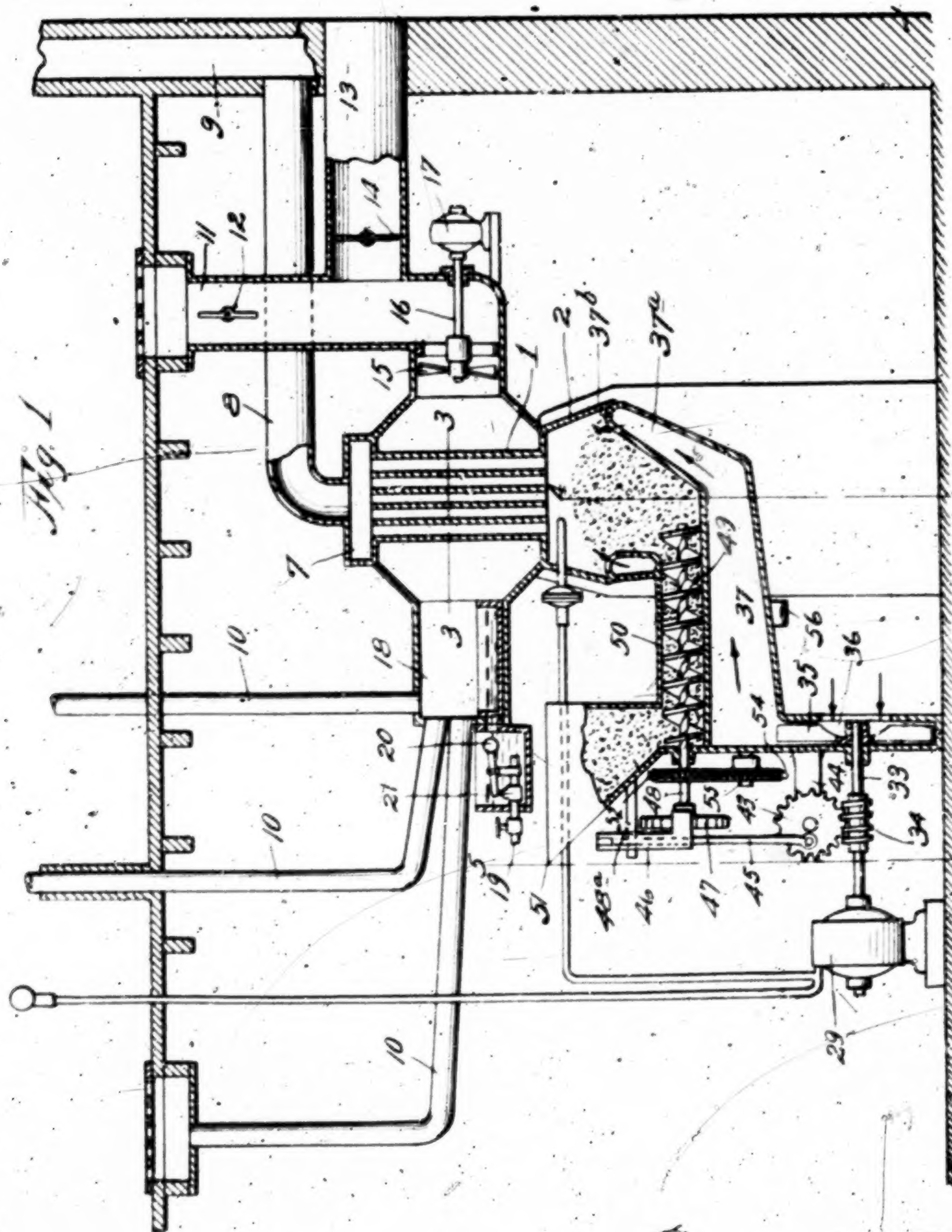


Fig. 1

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Witness

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DOMESTIC HEATING SYSTEM

Filed Nov. 11, 1926 3 Sheets-Sheet 2

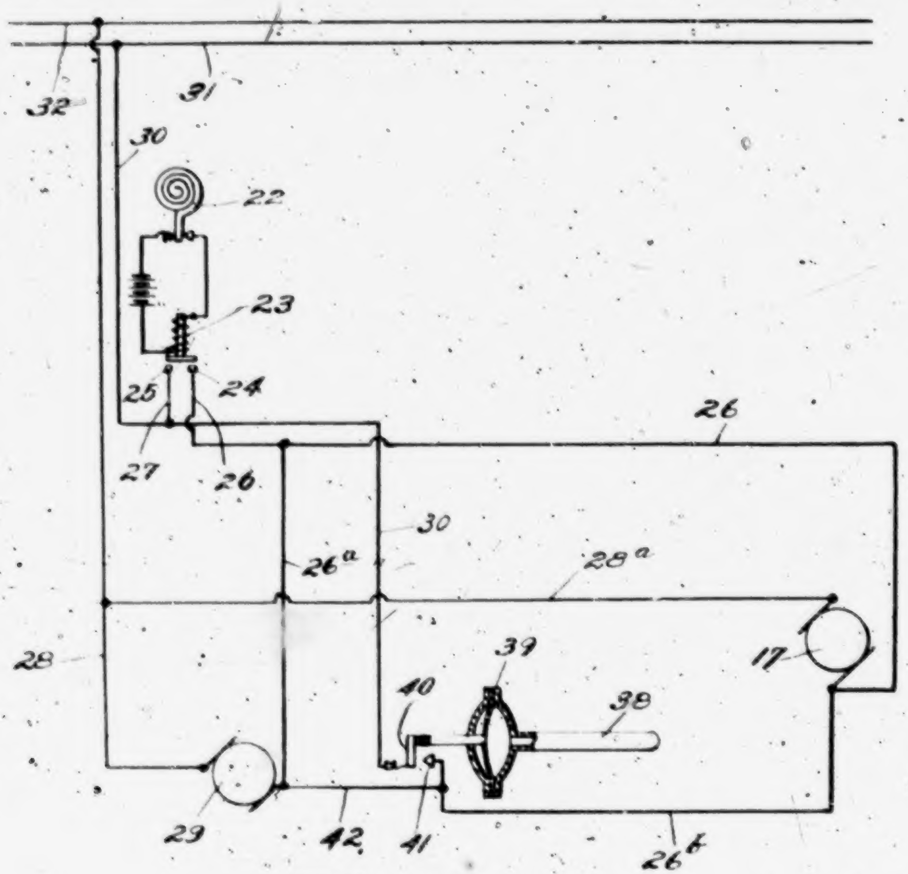

Fig. 2

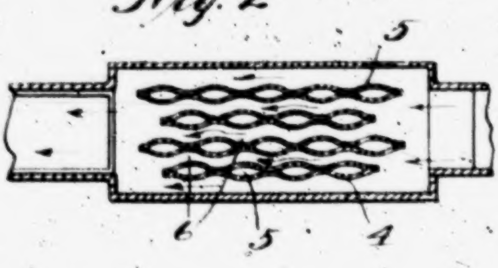

Fig. 3

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DOMESTIC HEATING SYSTEM

Filed Nov. 11, 1926 3 Sheets-Sheet 3

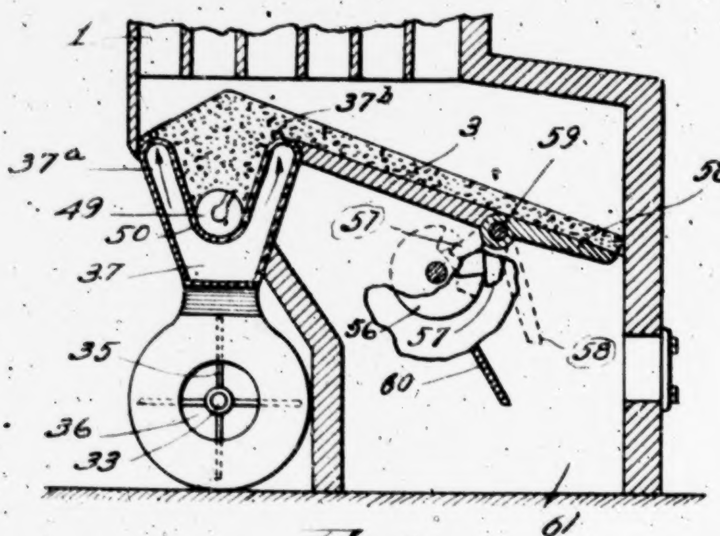


Fig 4

Fig. 5

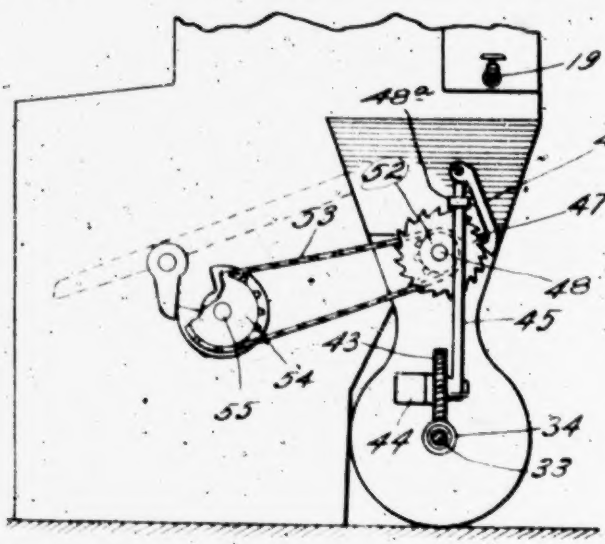
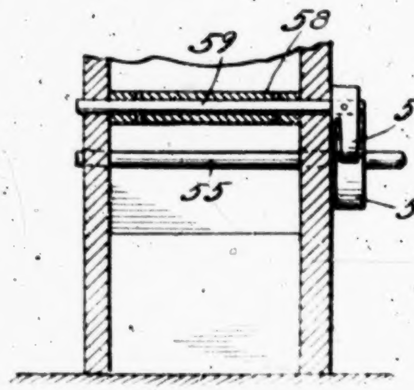


Fig. 6



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Patented May 13, 1930 1,758,146

UNITED STATES PATENT OFFICE

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DOMESTIC HEATING SYSTEM

Application filed November 11, 1926. Serial No. 147,667.

This invention relates to improvements in domestic heating systems, and refers more particularly to a hot air system of heating in which the combustion gases passing to the flue are reduced in temperature in their passage through a heat exchanging device below the kindling temperature of wood.

Among the particular objects of the invention are to provide a system having a furnace into which is mechanically and automatically fed a comminuted fuel, such as disintegrated coal, the fuel being underfed into the combustion pot, and overflowing onto an inclined grate, the grate terminating in automatic intermittently operated dumping device, whereby the ashes are removed from the grate and dumped directly into an ashpit; to provide a system which is automatically controlled by a dual system of control, one phase of the system operating the fuel feed and a force draft mechanism by variations in the room temperature of the dwelling, the other control functioning the fuel feed and force draft by predetermined minimum temperatures in the furnace or combustion pot, and in general to provide a system hereinafter described in more detail and incorporating a number of well known advantages of the modern type of heating system.

Fig. 1 is a diagrammatic side elevational view of a portion of the system, the furnace mechanism and its controls being shown in section, while the distributing pipes have been partially or totally eliminated for simplicity.

Fig. 2 is a detail view of the electrical control system.

Fig. 3 is a sectional view taken along the line 3—3 in Fig. 1, looking in the direction of the arrow.

Fig. 4 is a view taken along the line 4—4 in Fig. 1, looking in the direction of the arrow.

Fig. 5 is a view taken along the line 5—5 in Fig. 1, looking in the direction of the arrow, and

Fig. 6 is a fragmentary detail of a portion of the drive mechanism.

Referring to the drawings, at 1 is shown a heat exchanging device above a furnace comprising a combustion pot 2 and an inclined grate 3.

The heat exchanger consists in a plurality of corrugated sheets welded, or otherwise fastened together in pairs to produce a construction shown best in cross section in Fig. 3; these pairs of sheets are designated by the numeral 4 in Fig. 3, the tubular passageways produced by the pairing of the corrugated sheets are designated as 5, while the sinuous annular spaces between the elements 4 are designated as 6. The gases of combustion produced by the burning of fuel pass through the tubular passageways 5 and out through a top header 7 to the flue 8, and thence into the chimney 9.

The air which is heated and distributed through the pipe leads or distributing pipes 10 is supplied either through the return duct 11 controlled by a damper 12 or through an outside air inlet duct 13 regulated by a damper 14. A fan 15 mounted upon a shaft 16 and supported within the duct 11 is driven by a motor 17, the shaft of the motor carrying the fan being supported in suitable bearings in the duct. The purpose of the fan is to produce a positive circulation of the air through the system. This air, which is driven by the fan, is directed through an annular passageways 6 where it is heated, due to the fact that it brought in radiating contact with the highly heated outer surfaces of the tubular passageways 5 through which the combustion gases pass. On discharge from the heat exchanger the heated air passes through a humidifying chamber 18, in which is maintained a pool of water by a supply pipe 19, automatically controlled by a liquid level float 20, and valve 21, the control maintaining a constant water level in the humidifying chamber. After being humidified the heated air is directed through the respective distributing pipes or ducts 10, to the separate rooms of the dwelling, not shown in the drawings.

Referring now to the control which is detailed in Fig. 2. At 22 is a thermostat which controls the operation of the switch 23. 24 and 25 are contact points which are terminals of the lines 26 and 27 respectively. When the

temperature in the dwelling drops below the point at which the thermostat is set, the switch 23 is functioned, at which time the circuit is completed through the lines 26, 28ᵃ and 28, and 26, 26ᵃ and 28, starting the motors 17 and 29. The line 27 is connected by a line 30 to the power line 31, while the line 28 into which is connected the line 28ᵃ has connection with the power line 32. When the circuit is closed and the motor 29 started the shaft 33, carrying the worm 34 and fan 35 is rotated, the fan drawing the air through an inlet duct 36 and discharging it through the ducts 37 into the open channels 37ᵃ formed around the combustion pot 2, similar to an air jacket. The air is discharged from this jacket, or chamber, surrounding the combustion pot, through tuyères or openings 37ᵇ in the inner sides of the combustion pot near the surface of the burning fuel, or at a point substantially where the combustion takes place. To prevent the fire from being entirely extinguished during the periods when the system is shut off for any considerable length of time, a thermo-couple 38, shown in Figs. 1 and 2, is positioned in the combustion space of the furnace, just above the fire zone, and this thermo-couple is set at a predetermined temperature which temperature is regulated to operate the fuel feed and force drafts sufficiently to prevent total extinguishment of the fire. The variations in temperature acting upon the thermo-couple function a diaphragm valve 29 to bring a contacting surface 40 in engagement with the contact point 41 when the temperature in the furnace is reduced to a predetermined point. With the contacting of the elements 40 and 41, the electrical circuit is closed through the lines 30, 42 and 28, and 30, 26ᵇ, 28ᵃ, and 28 to start the motors 17 and 29 as they were started by the thermostat. The fire is continued until the furnace temperature is raised sufficiently high to break the contact between 40 and 41, shutting off the motors 17 and 29, which drive the fuel feed and force draft and the air circulation through the system.

Referring now to the drive for the fuel feed mechanism, the worm 34 meshes with a worm wheel 43, the latter being supported by a hanger 44. The lower end of the crank 45 is connected to the face of the worm wheel and is given a reciprocating movement, due to its offset position from the center of the wheel. This reciprocating movement is transferred to a dog 46, which engages the teeth of a ratchet wheel 47, the latter being mounted upon a shaft 48. The vertical reciprocating crank 45 slides in an upper guide member 48ᵃ which prevents also displacement of the dog from the ratchet. Upon the shaft 48 is also mounted a conveyor screw, 49 operating in a pipe 50 which serves as a conveying duct between the hopper 51 and the combustion pot 2. The rotation of the conveyor screw transfers the fuel from the hopper to the combustion pot where it is underfed to the combustion pot. A sprocket wheel 52 is also mounted upon the shaft 48, and drives the chain 53 which runs over a sprocket 54 mounted upon a shaft 55. This shaft 55 also carries a cam wheel 56 which has a portion of its outer surfaces cut away. The outer surface of the cam 56 rides against a depending tongue 57 of the dump grate 58, which is positioned at the end of the inclined grate 33. Through a considerable part of the rotation of the cam the dump grate is held in the full line position shown in Fig. 4, but, when the cut out portion is rotated so that the depending tongue can swing into a position shown in the dotted line position in Fig. 4, the grate being pivoted at 59 drops down, permitting the ashes or spent fuel gravitating along the inclined grate 3 to drop into the hopper 60 and thence into the ash-pit 61 below the furnace.

It is recognized to be common practice to circulate air through a furnace by means of a blower fan, and also to humidify this air prior to its distribution. It is recognized as common practice also to automatically stoke a furnace by means of a conveyor screw but to supply the fuel by an under feed device, and to inject the air substantially at the combustion point in the furnace and to allow the overflowing burning fuel from the combustion pot to gravitate downwardly over an inclined grate and at the end of this grate to automatically and intermittently dump the ashes into a pit, is thought to be a practice which is novel in the art.

Further more the dual electrical control apparatus—one control regulated by the variations in room temperature in the dwelling and a separate control operating simultaneously therewith functioned by a predetermined minimum temperature in the combustion zone of the furnace, constitutes another feature of the invention.

The fuel which is used is consumed always under the most economical conditions, as the system is either turned on full or entirely off, so that the most efficient operating conditions exist for combustion; or the system is what may be termed as in a smoldering or banked condition. There is no regulation of drafts as in the common type of hot air furnace, making for operation under varying conditions, none of which are perhaps economically proper and efficient for the fuel which is being used.

By this invention then, economical conditions of combustion are at all times enforced, for when the thermostat in the heated room reaches a predetermined temperature, there is a complete stoppage of the fuel feed mechanism and the forced draft fan. This permits then only the burning of the residual

fuel which when consumed would allow the fire to be entirely extinguished if it were not for the auxiliary control within the combustion pot, which functions when the furnace is cooled to say 200° F. This auxiliary control starting the fuel feed and force draft again institutes maximum operation until the temperature in the combustion pot is restored to 200° F., or at any other predetermined temperature selected for the minimum temperature of the furnace.

It may, under certain conditions, be desirable to have the auxiliary control or the control functioned by the furnace temperature connected only to the fuel feed and force draft, so that the air circulation or the operation of the fan 17 is dispensed with when the system is being operated to maintain the minimum furnace temperature.

In the construction of the heat exchanger 1, the relation of heating surface to fuel burned is at least that of 200 square foot surface per 1000 B. t. u. produced per minute. When this relation is used the stacked temperature is approximately 150° F. (a temperature well below the kindling temperature of soot or wood).

This mechanism then for the first time supplies a system in which under maximum operating conditions the stack temperatures are still below a temperature sufficiently high to burn or ignite wood or soot, and will at all times range below 250° F.

It is a well known fact that a large portion of the fires in domestic dwellings are occasioned by overheating of chimneys or flues connecting with the chimneys; a condition occasioned by high stack temperatures. By the use of the present invention these excessive stack temperatures would be impossible, as it would be impossible to operate the system so that the stack temperatures would rise above the kindling temperature of wood, as previously stated—this being due to the efficient heat exchange taken place between the combustion gases and circulating air. The relation then of the maximum combustion measured in B. t. u. units to the heating exchanging surface is such that the products of combustion are pooled to a temperature below the kindling temperature of wood or soot.

The system in combination with automatic stoker regulated simultaneously by a dual or double thermostatic control, which prevents the extinguishment of the fire and maintains a proper room temperature, comprises briefly the features of the system.

The furnace construction relies for its novelty upon underfeeding of a granulated or disintegrated fuel to a combustion pot and supplying air at substantially the combustion point; also, in the distributing of this overflowing burning fuel onto an inclined grate and automatically and intermittently dumping the ashes to a pit provided for that purpose.

I claim as my invention:

1. A heating system comprising a combustion pot, means for feeding fuel thereto, a combustion space above the combustion pot, means controlled by the temperature of the rooms to be heated for automatically regulating the fuel feeding means, and a separate thermostatic control actuated by predetermined minimum temperatures in said combustion space for preventing extinguishment of the fire when operating under low heat requirement conditions.

2. A heating system comprising a combustion pot, means for feeding fuel thereto, a combustion space above the combustion pot, means controlled by the temperature of the rooms to be heated for turning on and off the feeding means, and a separate thermostatic control actuated by a predetermined minimum temperature in said combustion space for preventing extinguishment of the fire when operating under low heat requirement conditions.

3. A heating system of the character described comprising a combustion pot, means for feeding fuel thereto, means for forcing air to said combustion pot, means controlled by the temperature of the rooms to be heated for automatically turning on and off the fuel feeding means and the air forcing means, a combustion space heated by said combustion pot and a separate thermostatic control actuated by a predetermined minimum temperature in the combustion space for preventing extinguishment of the fire when operating under low heat requirement conditions.

4. A domestic heating plant of the character described comprising a combustion pot, an automatic stoker adapted to supply fuel thereto, means controlled by the temperature of the rooms to be heated for turning on and off the stoker, and a separate thermostatic control actuated by the predetermined minimum temperature of the combustion space for preventing extinguishment of the fire when operating under low heat requirement conditions.

5. A force draft furnace for a heating system having a power driven underfeed stoking element, a dual thermostatic control mechanism connected to the stoker driving means, one thermostat mechanism functioning by variations of the temperature in the space to be heated, and the other by predetermined minimum temperature within the furnace to prevent extinguishment of the fire.

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MERCOID EXHIBIT ZZ

Aug. 4, 1931. I. E. McCABE 1,817,634

PRESSURE ACTUATED SWITCH OPERATING DEVICE

Filed April 26, 1928 4 Sheets-Sheet 1

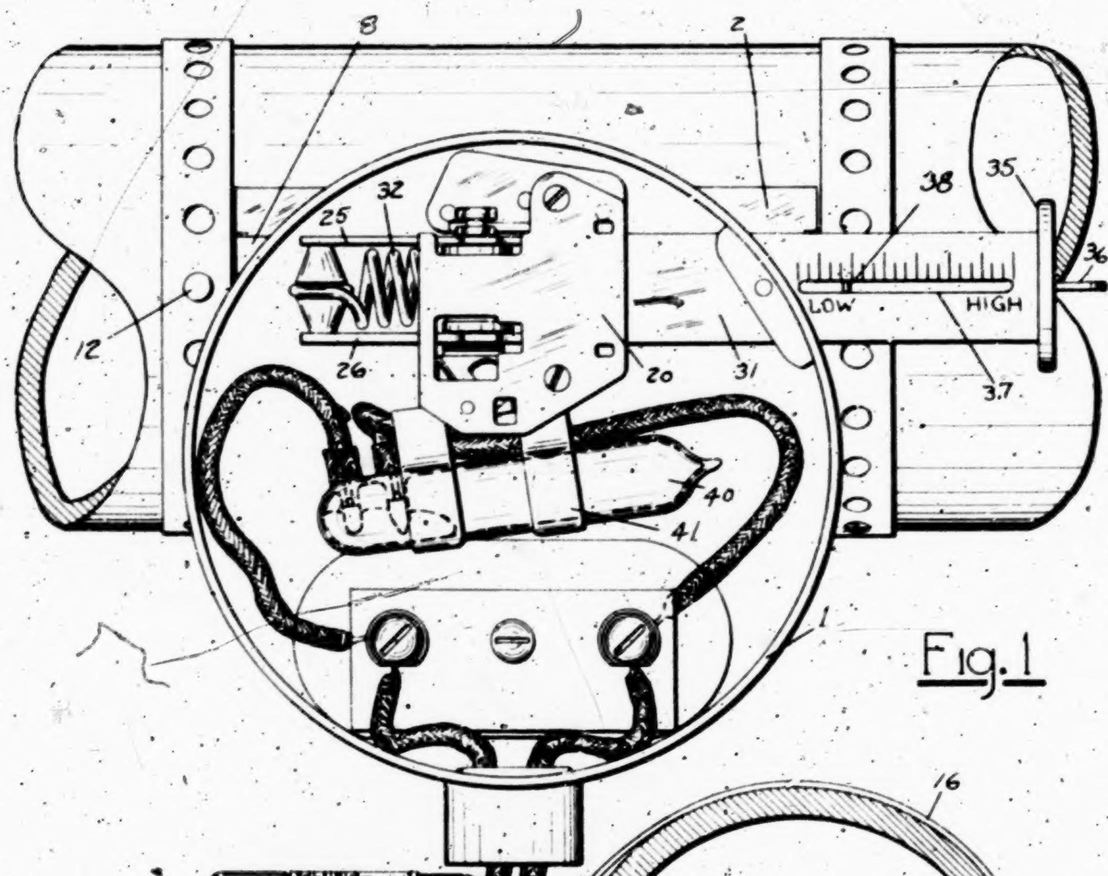

Fig. 1

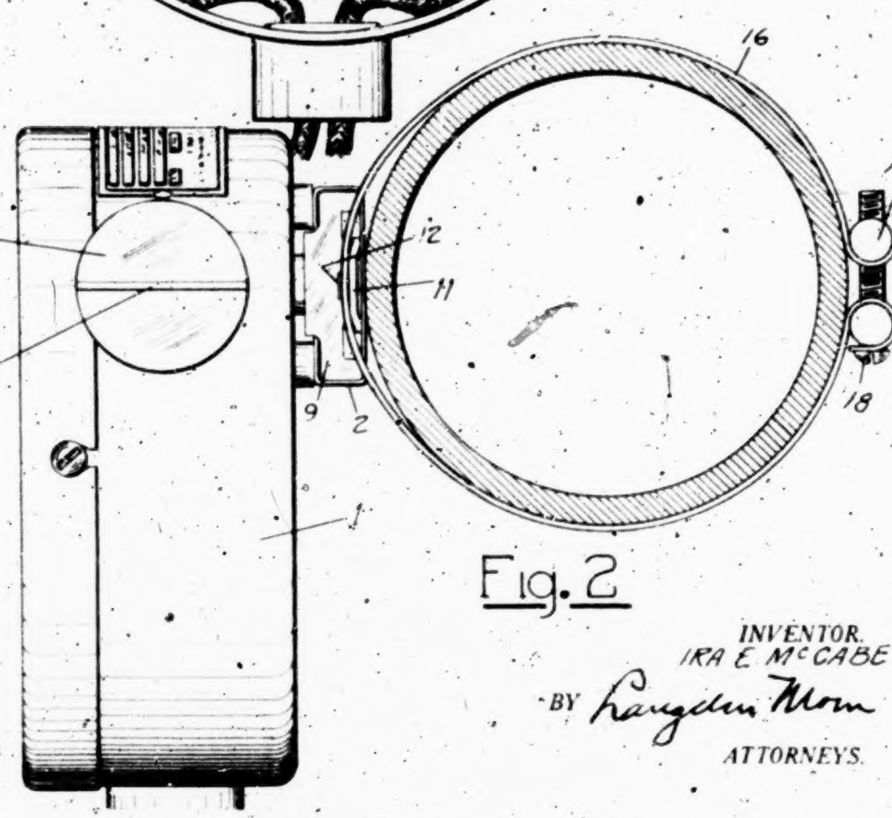

Fig. 2

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PRESSURE ACTUATED SWITCH OPERATING DEVICE

Filed April 26, 1928 4 Sheets-Sheet 2

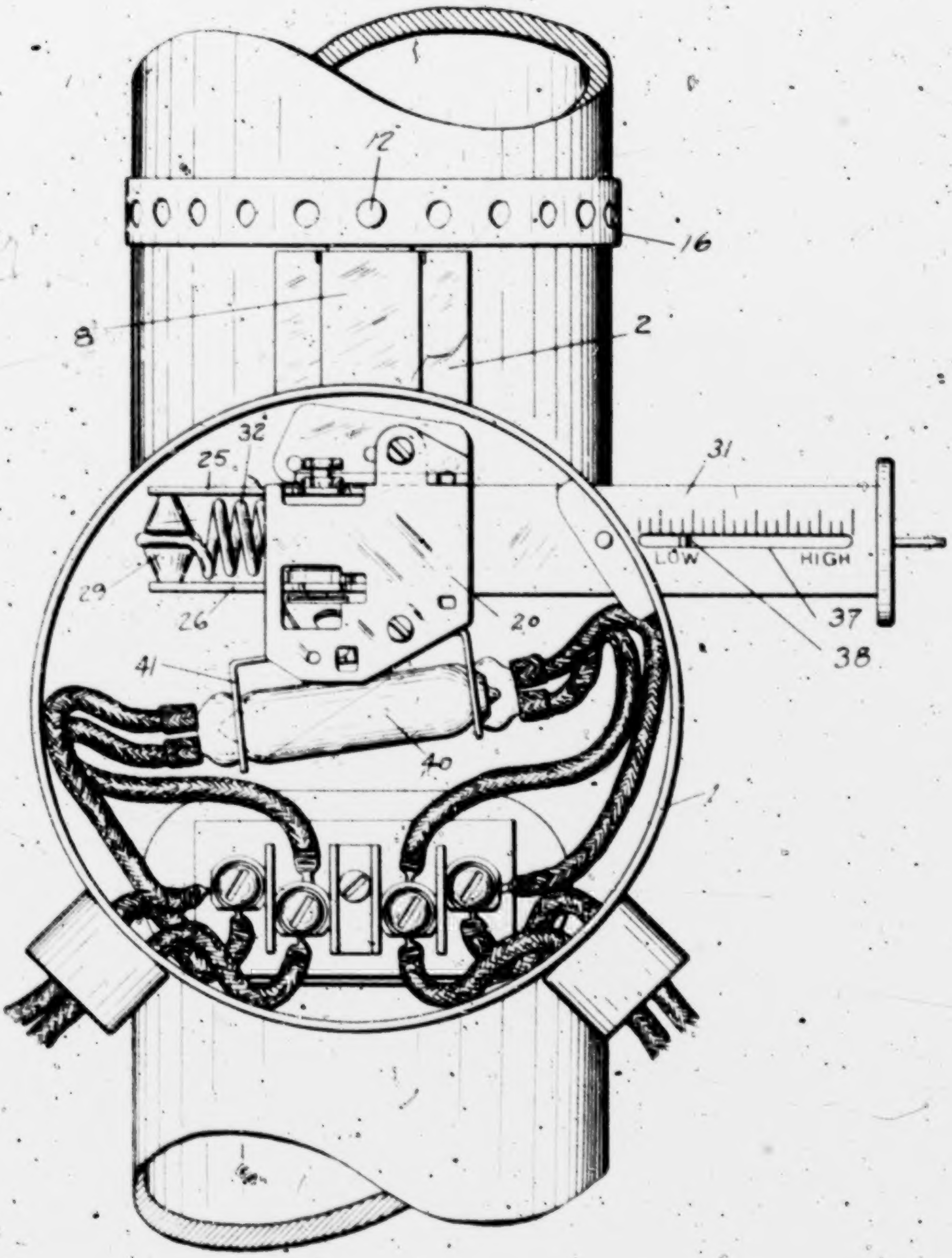

Fig. 3

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PRESSURE ACTUATED SWITCH OPERATING DEVICE

Filed April 26, 1928 4 Sheets-Sheet 3

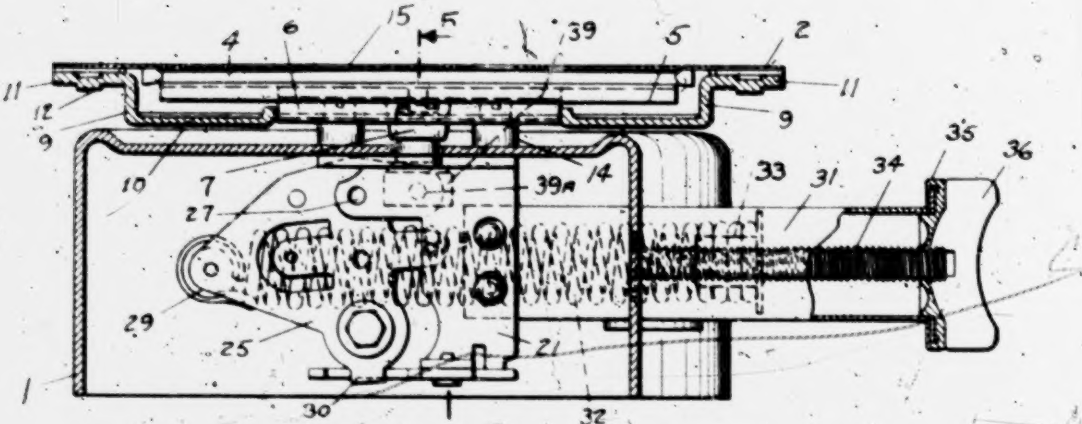

Fig. 4

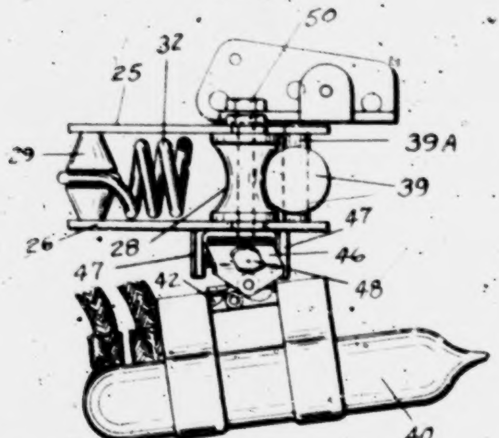

Fig. 6

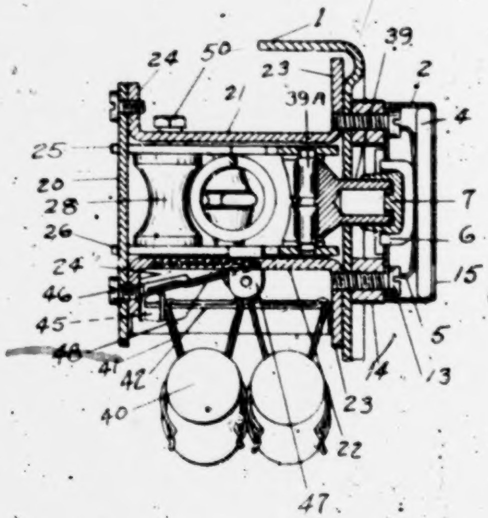

Fig. 5

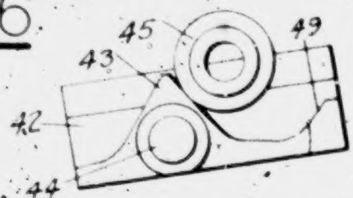

Fig. 7

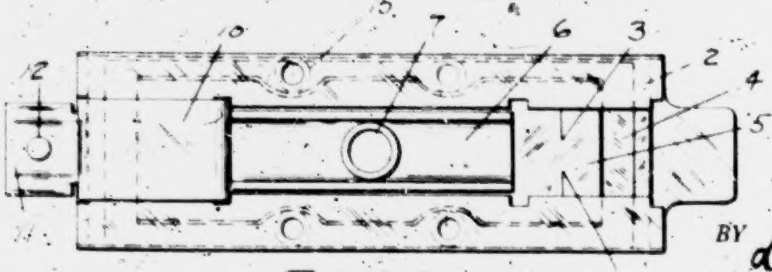

Fig. 14

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PRESSURE ACTUATED SWITCH OPERATING DEVICE

Filed April 26, 1928 4 Sheets-Sheet 4

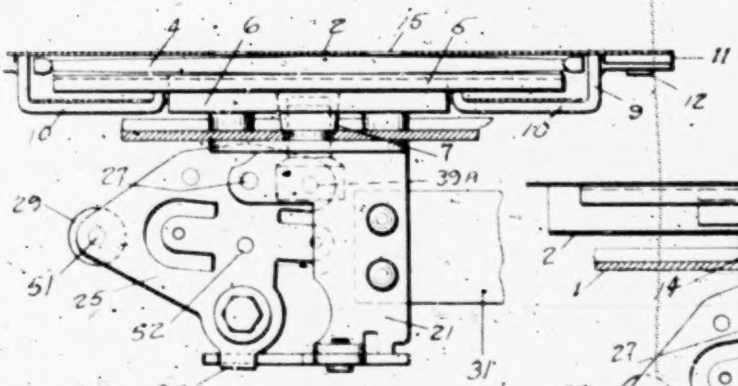

Fig. 8

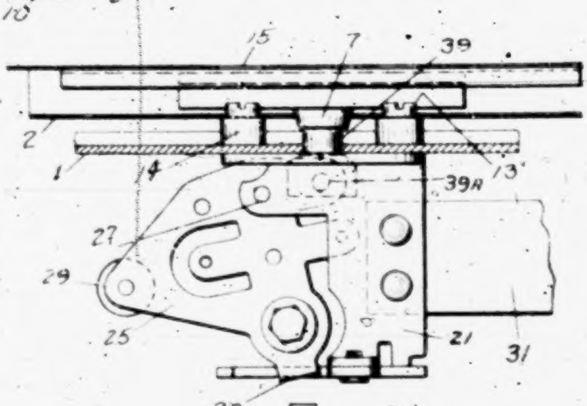

Fig. 11

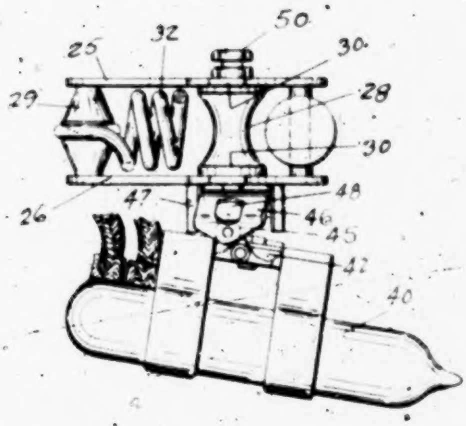

Fig. 9

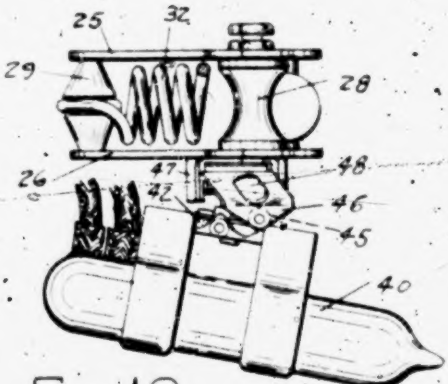

Fig. 12

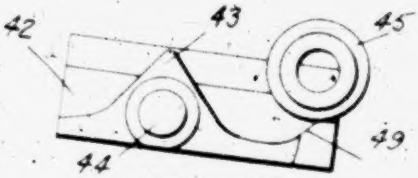

Fig. 13

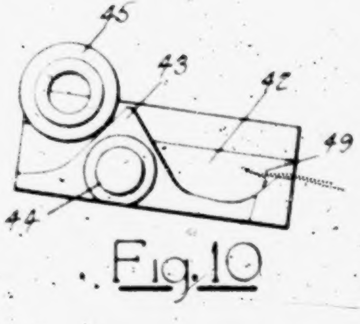

Fig. 10

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1173

UNITED STATES PATENT OFFICE

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PRESSURE ACTUATED SWITCH OPERATING DEVICE

Application filed April 26, 1928. Serial No. 272,886.

This invention relates to improvements in pressure actuated mechanism for operating electric switches and more particularly to electric switch operating mechanism provided with an expansible and contractible actuating element whereby changes in the temperature of said element operates the switch and means for attaching said mechanism to a body the temperature of which controls the operation of said switch.

It is an object of this invention to provide in an electric circuit which controls the operation of mechanism for producing changes in temperature, such as electrically operated oil burning or refrigerating machines, a switch which will be actuated by predetermined changes in the temperature produced by said mechanisms to close or break said controlling circuit.

One of the many uses of this invention is its application to control an electrically operated oil burner as installed in connection with a hot water domestic heating system. Devices for this purpose have heretofore been employed having a thermostatic member adapted to be actuated by contact with the water and have necessitated a hole being drilled in the boiler wall for the insertion of the thermostatic member and thereafter the provision of a water tight packing and joint. One of the most obvious advantages of the present invention is that the device may be readily applied to the exterior of the boiler or to the pipe through which the heated water rises from the boiler, to enter the heating system, commonly called the riser, and by the improved attaching means whereby it may be clamped on to the riser, whether it be vertical or horizontal both of which being usual commercial constructions, with the switch operating mechanism in operative position and control the burner circuit in the same manner as if directly in contact with the hot water. It is felt that a description of this particular application will be a sufficient disclosure to others skilled in the art to apply the same to the other uses to which it is adaptable.

In describing this embodiment of this invention reference is made to the accompanying sheets of drawings, with the understanding that minor detail changes may be made therefrom without departing from the scope of the invention.

In the drawings:

Figure 1 is a view in front elevation of this improved device as attached to a horizontal pipe or riser of a hot water heating system, with the front of the casing removed.

Figure 2 is a view in end elevation of Figure 1.

Figure 3 is a view similar to Figure 1 in which the device is attached to a vertical pipe or riser.

Figure 4 is a top plan view of Figure 1 in which the switch casing is shown in section as well as the actuating casing.

Figure 5 is a detail view in vertical transverse section taken through the operating and actuating mechanism on the line 55, Figure 4.

Figure 6 is a detail view in front elevation of the operating mechanism with the front plate removed.

Figure 7 is an enlarged detail view in front elevation of a part of the switch operating mechanism.

Figure 8 is a detail fragmentary plan view of the actuating and operating mechanisms, with the casings of each in section, showing the relation of the parts when the temperature has increased sufficiently to actuate the mechanism to throw the switch to break the electrical circuit.

Figure 9 is a detail view in front elevation, with the front plate and casing removed illustrating the relation of the parts when in the position shown in Figure 8.

Figure 10 is an enlarged detail view in front elevation showing the relation of parts of the operating mechanism when in the position shown in Figure 9.

Figures 11, 12 and 13 are views similar to Figures 8, 9 and 10 showing the position assumed by the various parts of the operating mechanism should the actuating mechanism fail or become inoperative by destruction of the power element.

Figure 14 is a plan view of the actuating

mechanism casing removed from the operating mechanism casing looking at that part which engages the latter casing, with one end cap removed.

As shown in Figures 1, 2 and 3, the switch operating mechanism is enclosed with a cylindrical casing 1 and the actuating device therefor within a flat oblong casing 2. The actuating mechanism casing 2 is preferably formed of thin resilient metal and is rectangular in transverse section, as shown in Figure 5. The side adapted to be secured adjacent the rear wall of the cylindrical switch casing 1 is provided with a longitudinal opening 3, Figure 14, extending throughout its length and the opposite side is provided with an extension at each end approximately the same width as the said longitudinal opening. The actuating or power element comprises an elongated flat thin metallic capsule 4 hermetically sealed and containing a fluid readily responsive to changes in temperature to cause the flat sides to expand and contract, as more fully described in the applicant's copending application Serial No. 228,258 filed Oct. 24, 1927.

One flat side of the capsule 4 rests upon the exterior side of the casing and a follower plate 5 is arranged between the other flat side and slotted side of the casing adjacent the switch casing. This follower plate 5 is of slightly less length and width than the capsule and slides readily within the casing. An elongated guide member 6 is secured centrally upon the follower plate to extend upwardly through the longitudinal opening on that side of the casing provided with longitudinal side walls adapted to maintain sliding contact with the edges of the casing during expansion and contraction of the capsule. A power transmitting sleeve 7 is centrally mounted upon the guide member extending beyond that side of the casing. The guide member 6 is positioned with the sleeve 7 in the center of the casing and over the center of the capsule and the capsule is retained within the casing by caps 8 detachably secured on each open end of the casing. Each cap 8 is provided with a portion 9 adapted to fit within the end walls of the casing and close the same whereby the capsule 4 is retained in position. This closure portion 9 is provided with an extension 10 from one side slightly greater than the opening between the walls of the flat sides of the casing 2 and is formed to engage the flat walls thereof and terminate in a bend in the direction of the opposite flat casing side to form a hook to engage in oppositely disposed notches in the casing walls, and with an extension 11 from the other side of substantially the same shape and adapted to lie over the end extension of the flat extension of casing body, whereby by depressing the exterior end of the extension 11, due to the spring in the casing extension, the hook on the other extension 10 may be engaged or disengaged from the casing body. This extension 11 is provided with a central outwardly extending stud 12, the purpose of which will hereinafter be described. The guide member is of such length as to be engaged by the ends of the portions 10 of the caps 8 to properly position the power transmission sleeve 7.

The power element casing is preferably secured to the switch casing by four screws 13 and held in spaced relation thereto by screw threaded sleeves 14 on each screw arranged between the said casings. It is preferable to arrange these screws 13 equidistant from each other and from the power transmission sleeve 7 and provide openings 15 therefor for their insertion through the flat outer side of the casing 2 with their heads engaged with the interior of the inner walls of the opposite side. To insert the screws 13 apertures 15 are provided in the outer flat side of casing 4 through which the heads of the screws may be passed to engage the inner surface of the opposite flat side of the casing and then through the sleeves 14 to hold the same in engagement with the switch casing so that the actuating casing must be secured to the switch casing before the power element capsule 4 and follower plate 5 are inserted, thereby preventing the disengagement or removal of the actuating casing after the installation of the power element 4.

With the power element attached to the switch casing, the device is preferably secured to the pipe or tank, the temperature will control the operation by placing the flat and longitudinal outer side of the casing 2 against the longitudinal surface of the pipe or tank, passing strips 16 of perforated metal about the pipe or tank with one of the perforations in each strip engaging with the stud 12 upon each end cap 8, and drawing the strips tight against the pipe or tank, as shown in Figure 2, preferably by the employment of two cylindrical members 17, approximately in length the width of the strip, each having a central transverse screw threaded aperture adapted to receive a securing screw 18 whereby the screw passing through one member 17 and through a perforation of the strip may be passed through a perforation in the other end of the strip and engaged with the other member 17 and secured. The screws 18 draw the ends of the strips toward each other and firmly clamp the device in place, the engagement of the studs 12 with the perforations prevent the strips from becoming disengaged as well as the casing from slipping from its original position. Inasmuch as the perforated strip may be of any desired

length, the size of the pipe or tank is immaterial. Since the outward extensions 11 of the caps 8 rest upon the casing extension when the hooked ends of the inward extensions 10 engage the notches in the casing walls and since the casing is of resilient metal, to attach or detach the caps 8 the outward extension 11 is depressed against the casing extension and the hooked portion of the cap is readily snapped into or out of engagement with the casing but when the casing is held against a pipe or tank the whole body of the casing is held rigid, so the cap can not become detached after the device has been clamped on the pipe or tank.

Since the switch operating mechanism includes a mercury tube switch to be operative, it is necessary that the switch casing be secured to the pipe or tank with the mercury tube in a certain predetermined relation to the vertical. As shown in Figures 1 and 2, the actuating member casing 2 is arranged to clamp the switch casing 1 upon a horizontal pipe or tank with the mercury tube switch in operating position. Since the actuating casing is secured to the switch casing by four screws equidistant from each other and from a common center, when it is desired to clamp the switch casing upon a vertical pipe or tank, it is only necessary to remove one of the caps 8, withdraw the power element or capsule 4 and follower plate 5, unless said follower plate is recessed about each screw head, to expose the screw heads through the opening 15. The screws may then be detached from the switch casing 1, the actuating casing 2 rotated one quarter turn, the screws again engaged with casing 1, the power element or capsule and follower plate reinserted, the cap snapped into engagement, and the device is ready to be clamped upon a vertical pipe or tank as shown in Figure 3.

The switch operating mechanism comprises a rectangular frame, as shown in transverse section in Figure 5, including a front plate 20 with spaced-apart top and bottom plates 21 and 22, each having formed flanges 23 adapted to rest against the rear wall of the casing 1 and be secured thereto and formed up ears 24 adapted to be secured to the front of plate 20. The operating member of the switch mechanism comprises two spaced-apart triangular plates 25 and 26 held in rigid relation to each other by the pivot pin 27 adjacent one apex having portions extending through and beyond each plate to pivotally engage bearings in the top and bottom plates 21 and 22 respectively, by an oppositely disposed spacing member 28 adjacent another apex, and, adjacent the third apex and thereof intermediate the others, by a spring anchor 29 also engaging both plates 25 and 26, whereby the operating member is mounted to oscillate within the frame. Each plate 25 and 26 is provided with an extension 30 projecting outward from the spacing member 28 between openings provided therefore in the front plate 20 so as to engage the front plate to limit the oscillation of said plates.

Extending from the side of the frame of the oscillating operating member a box like casing 31 is secured to the plates 21 and 22 which passes out through the side of casing 1 to house a coil spring 32 secured at one end to the spring anchor 29 and at the other end to a screw threaded block 33 mounted to travel longitudinally within the box casing 31 upon a screw threaded shaft 34 having a circular cap 35 adapted for rotation about the outer end of the box casing 31 and having a diametrical fin 36 projecting outwardly therefrom for manually adjusting the tension of the spring. It is preferable to provide a slot 37 on the front of the box casing which extends beyond the switch casing, through which an indicating pointer 38 upon the block 33 is visible and to graduate the edge of the slot to indicate the spring tension. An additional location 52 for spring anchor 29 is provided which may be used. The proper position to secure a uniform differential in connection with expansive liquids usually used is at 51 Fig. 8. When at 52 the differential in pounds is uniform or nearly so, but the temperature differential will decrease as the temperature rises.

The spring anchor 29 being to one side of the pivot 27 of the operating member, the spring 32 normally exerts a pull to rotate the member in that direction. A power transmission stud 39, adapted to be received within and be engaged by the power transmission sleeve 7 of the actuating mechanism is mounted upon a pivot 39—A mounted in bearings provided therefor in the operating member plates 25 and 26 upon the side of the plate pivot 27 most distant from the spring anchor 29, which stud 39 passes through an opening in the rear wall of the switch casing 1, so that upon expansion of the power element capsule movement will be transmitted through the sleeve 7 and stud 39 to cause the operating member to be rotated about its pivot 27 against the tension of the spring 32.

The switch 40, adapted to be operated by the operating mechanism, is of the type commercially known as a mercury tube switch and may be of any approved style of mercury switch in which the terminals of the circuit to be controlled are arranged in spaced-apart relation with a sealed tube containing a quantity of mercury so that when the tube is tilted with one end lower than the other the mercury will flow into that end and close the contact between the terminals and close the circuit and when tilted in the

opposite direction the mercury will flow into the opposite end, away from the terminals, and break the circuit. As shown in Figures 1 and 3, the mercury tube switch 40 is supported in clamps 41 and Figures 5, 6, 9 and 12 show the clamps 41 depending from a switch supporting plate 42, which is shown in Figure 5 as being pivotally mounted in bearings provided in the front plate 20 and dependent flange 23 of the bottom plate 22. In order to tilt the switch plate 42 about its pivot 44 to operate the switch to make and break the circuit, a portion of the switch plate, preferably the outer end, is provided with an irregular track having an upward triangular projection 43 the apex of which is in a line passing through the center of the pivot member 44 of the plate 42 and perpendicular to the plate, with equally sloping side which curve with the bottom of the track. A roller 45 is arranged to travel over the track, which roller is mounted at the free end of a spring pressed member 46 pivoted between ears 47 formed down from the lower plate 26 of the operating frame whereby rotation of the operating member about its pivot 27 causes the roller 45 to travel over the track on the end of the pivoted switch supporting plate 42. A spring 48 Figure 5, is shown with one end engaging the member 46 passing beyond the pivot thereof and then bent back upon itself to engage the under side of the plate 26. The tension of this spring 48 is adjusted by means of a screw 50 which passes through the center of the spacing member 28 and through plate 26 to engage the portion of the spring 48 which bears upon the underside of said plate. The relation of the roller 45 and the triangular projection 43 of this track is so arranged that when the entire device is clamped on a pipe or tank in operative position and the temperature thereof has increased to or above the predetermined or desired degree said increase in temperature will have caused the power element or capsule 4 to expand, which movement will be imparted through the power transmission sleeve 7 and stud 39 to cause the operating member 25 to rotate against the tension of the spring 32 to the position shown in Figure 8 and when in this position the roller 45 will engage one sloping side of the projection 43 of the track as shown in Figures 9 and 10 and tilt the switch carrying plate 42, as shown about its pivot 44 to tilt the mercury tube switch to open position. When the temperature within the pipe or tank decreases below that predetermined or desired, the capsule 4 contracts and the tension spring 32 causes the operating member to rotate about its pivot 27 in the opposite direction and through the spring pressed member 46 causes the roller 45 to travel over the apex of the projection 43 and engage the opposite sloping side thereof, as shown in Figures 6 and 7, whereby the mercury tube switch is tilted to closed position. As the capsule 4 or power element, acted upon by the changes in temperature of the pipe or tank, expands and contracts in response to the fluctuation of said temperature, the mercury tube switch will be tilted back and forth to open and close the circuit it controls. Should the capsule become defective or punctured so that it collapses it will contract more than normal movement to the operating member, whereby a greater than normal movement will be imparted to the roller 45 away from the track projection 43. As a safeguard to insure the breaking of the circuit, should such a failure of the actuating element occur, an additional projection 49 is provided upon the track with an angular projection parallel to the "off" position angular side of projection 43 which the roller will engage and tilt the switch to the open position as shown in Figures 12 and 13. The roller and switch will assume this "off" position whenever the capsule 4 is removed from its casing, such as when it is desired to change the actuating casing relative to the switch casing.

The extra travel of the mechanism to off position as shown in Figures 11, 12 and 13 may be left off if desired, by proper location of the stops on front plate 20, so as to permit of but two position operation.

At times it is desirable to control two circuits and in such a case two mercury tubes are adapted to be supported in an additional set of clamps supported upon the plate 42, as shown in Figure 5. Figure 3 illustrates two circuits, each connected to a mercury tube switch, in which one circuit is broken when the other is closed.

What I claim is:—

1. A pressure actuated switch operating device, comprising an actuating mechanism including a temperature responsive expansible and contractible element contained within a casing and a switch operating mechanism contained within a separate casing, means for attaching the two casings to each other and forming a transmission connection between the actuating and operating mechanisms, and means for clamping the actuating casing upon a fluid container including means preventing the removal of the expansible and contractible element when the device is in clamped position.

2. A pressure actuated switch operating device, comprising an actuating mechanism including a temperature responsive expansible and contractible element contained within a casing and a switch operating mechanism contained within a separate casing, means for attaching the two casings to each other and forming a transmission connection

between the actuating and operating mechanisms, and means for clamping the actuating mechanism upon a fluid container including a detachable closure for the actuating mechanism casing adapted to be engaged by said clamping means and prevent the removal of the expansible and contractable element.

3. A pressure actuated switch operating device, comprising a temperature responsive expansible and contractible capsule, a casing therefor, detachable closures for the casing, a switch operating mechanism contained within a separate casing, means for attaching the two casings to each other and forming a transmission connection between said capsule and said operating mechanism, and means for clamping the capsule casing upon a fluid container and preventing detachment of said closures from the casing when the device is in clamped position.

4. A pressure actuated switch operating device, comprising a temperature responsive expansible and contractible flat capsule, a casing therefor snugly receiving said capsule, a switch operating mechanism contained in a separate casing, means for attaching the empty actuating casing to the operating casing, a power transmission connection carried in the actuating casing, the insertion of the flat capsule in the empty casing after being attached to the other casing, acting to bring the power transmission connection in contact with the switch operating mechanism and render the attaching means secured against detachment.

5. A pressure actuated switch operating device, comprising a temperature responsive expansible and contractible capsule, means to transmit the movement of the capsule in expanding and contracting to a switch operating member, means connecting said operating member to a switch to throw the switch to open position when the capsule expands beyond a predetermined degree, a spring acting upon the operating member to actuate the operating member to throw the switch to closed position when the capsule contracts to said predetermined degree, and means upon abnormal contraction of the capsule to actuate the operating member to throw the switch to open position.

6. A pressure actuated switch operating device comprising a temperature responsive pressure actuated member, a switch operating mechanism and means to transmit movement from the pressure member to the operating mechanism, said switch operating mechanism including a spring actuated pivoted operating member normally in engagement with the movement transmitting means, a pivoted switch carrying member mounted to rotate at right angles to the operating member, and means actuated by rotative movement of the operating member to rotate the switch carrying member to operate the switch.

7. A pressure actuated switch operating device comprising a temperature responsive pressure actuated member, a switch operating mechanism and means to transmit movement from the pressure member to the operating mechanism, said switch operating mechanism including a pivoted operating member, a spring normally holding the operating member in engagement with the movement transmitting means, a switch carrying member, a pivot therefor mounted at right angles to the pivot of the operating member, means upon the switch carrying member co-operating with means carried upon the operating member to operate the switch upon variation of pressure of the pressure actuated member.

8. A pressure actuated switch operating device comprising a temperature responsive pressure actuated member, a switch operating mechanism and means to transmit movement from the pressure member to the operating mechanism, said switch operating mechanism including a pivoted operating member, a spring normally holding the operating member in engagement with the transmitting means, means for adjusting the tension of the spring, a mercury tube switch, a pivoted switch carrying member, mounted to rotate at right angles to the operating member, means upon the switch carrying member co-operating with a spring pressed member carried upon the operating member to snap the mercury tube to open and closed position upon transmission of movement from the pressure actuated member.

9. A pressure actuated switch operating device comprising a temperature responsive pressure actuated member, a switch operating mechanism and means to transmit movement from the pressure member to the operating mechanism, said switch operating mechanism including a pivoted spring actuated operating member normally in engagement with the transmitting means, a pivoted switch carrying member, a mercury tube switch carried thereby, a spring pressed roller mounted on the operating member, an irregular track mounted upon the switch carrying member over which the roller is adapted to travel with the irregularities so formed that movement of the roller in one direction rotates the carrying member in one direction and thereafter movement in the opposite direction imparts a rotation in the opposite direction.

10. A pressure actuated switch operating device comprising a temperature responsive pressure actuated member, a switch operating mechanism and means to transmit movement from the pressure member to the operating mechanism, said switch operating

mechanism including a pivoted spring actuated operating member normally in engagement with the transmitting means, a pivoted switch carrying member, a mercury tube switch carried thereby, a spring pressed roller mounted on the operating member, an irregular track mounted upon the switch carrying member over which the roller is adapted to travel with the irregularities so formed that movement of the roller in one direction rotates the carrying member in one direction and thereafter movement in the opposite direction imparts a rotation in the opposite direction, and continued movement in that direction returns the switch carrying member to the first position.

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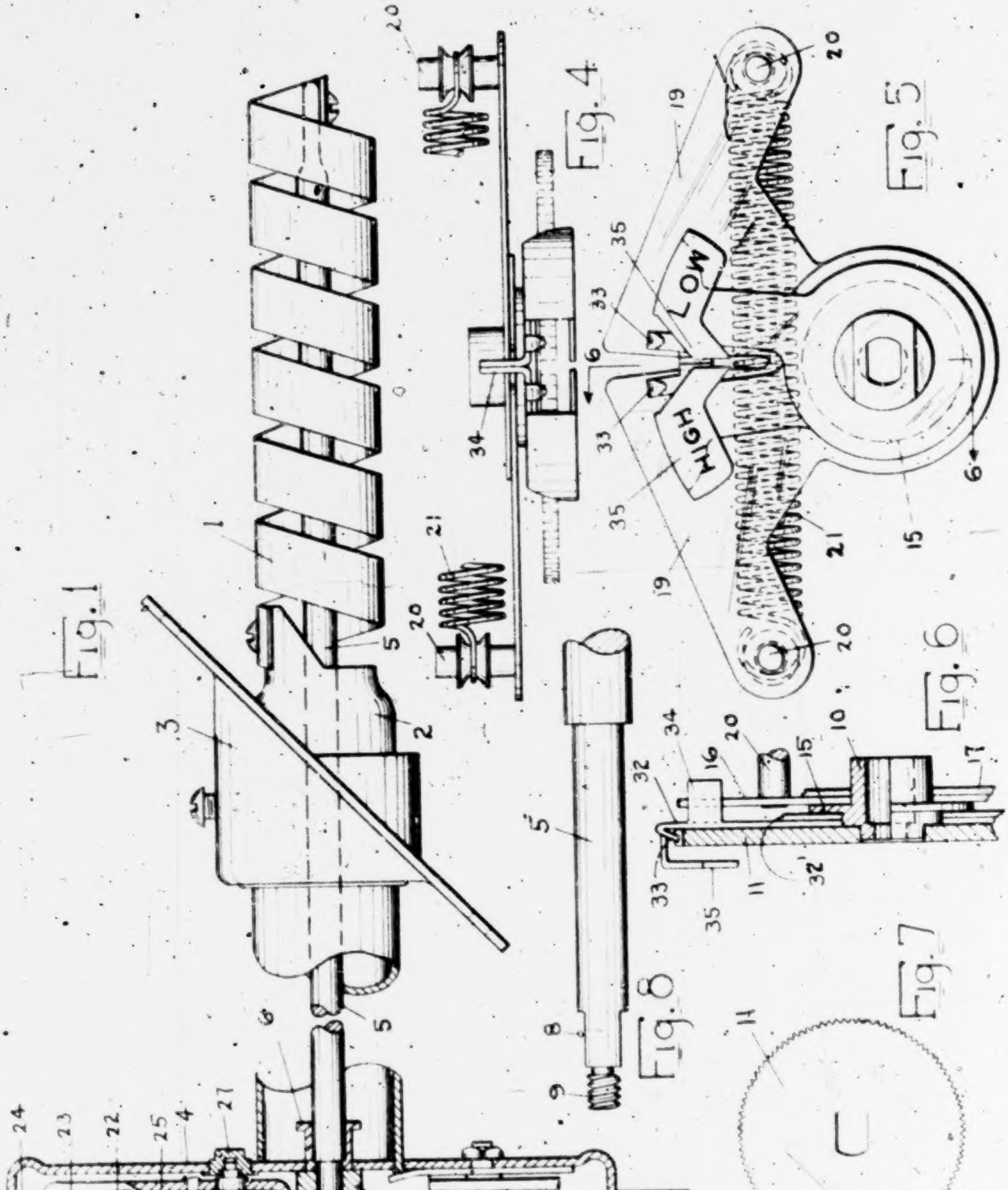
Dec. 1, 1931. I. E. McCABE 1,834,288

ELECTRIC SWITCH MECHANISM

Filed Aug. 5, 1929 2 Sheets-Sheet 1



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ELECTRIC SWITCH MECHANISM

Filed Aug. 5, 1929 2 Sheets-Sheet 2

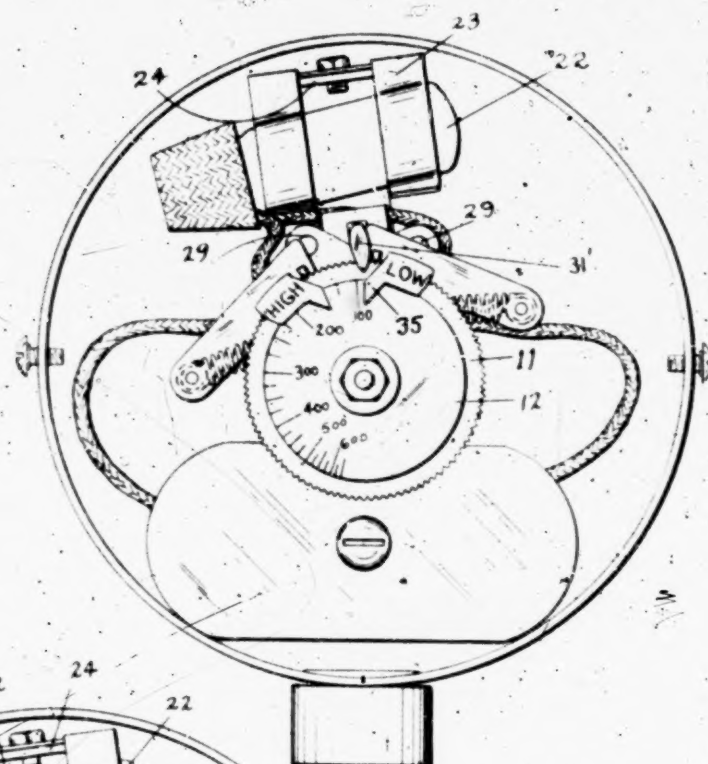

Fig. 2

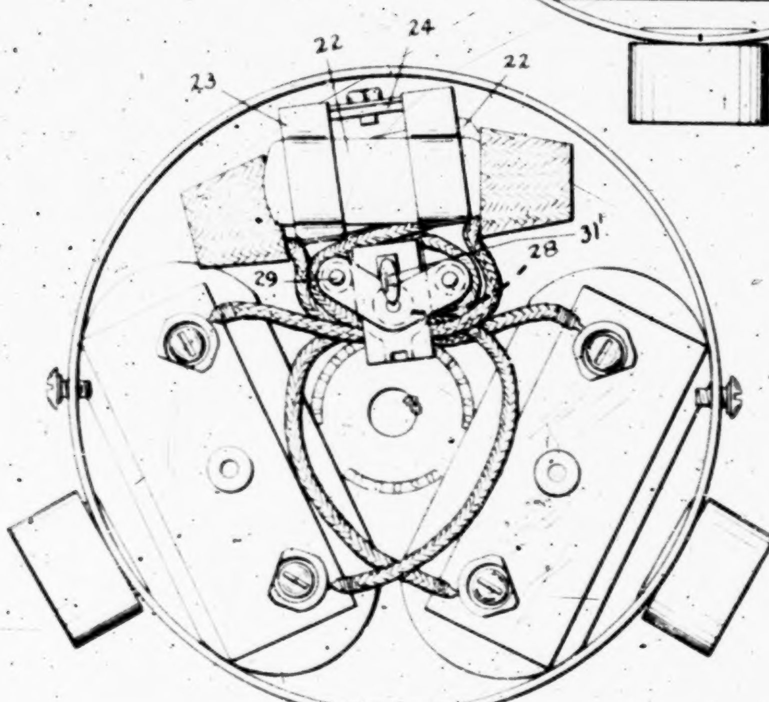

Fig 3

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UNITED STATES PATENT OFFICE

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ELECTRIC SWITCH MECHANISM

Application filed August 5, 1929. Serial No. 383,568.

This invention relates to improvements in electric switch mechanism and in particular to an electric switch mechanism which is responsive to temperature changes.

It is an object of this invention to provide a device of this character which is actuated by changes in temperature to make and break an electric circuit, and is advantageously employed as a safety device in electrically operated oil burning heating systems. The purpose of this device is to break the motor circuit of the oil burner and thereby discontinue the combustion in the furnace or heater when the temperature of the combustion reaches a degree which is dangerous to the furnace or heater. In order to produce a device of this kind which will be readily adapted to various types and sizes of heaters in which the degrees of heat produced by the combustion without endangering the furnace or heater may vary, in accordance with the respective types or sizes, it is necessary that the device be adjustable, and further desirable to have at hand indicating means showing the actual temperature of the furnace or heater in which the device is installed. It is another object of this invention to provide a safety device of this character which may be set on the job to break the motor circuit when the degree of temperature dangerous to the particular type or size of heater or furnace is approached.

This invention provides means for indicating the actual temperatures of the furnace and means for indicating the temperature at which the control will operate to make or break the circuits, together with means for quickly and conveniently adjusting the instrument to operate at the desired temperatures.

With these and other objects in view reference is made to the accompanying sheets of drawings which illustrate a preferred form of this invention with the understanding that minor detail changes may be made therein without departing from the scope thereof.

In the drawings:

Figure 1 is a view partly in side elevation and partly in vertical central longitudinal section illustrating the application of this invention with the mercury tube switches omitted.

Figure 2 is a view in end elevation of Figure 1 with the cover of the switch mechanism casing removed, illustrating the use of a single mercury tube switch.

Figure 3 is a view similar to Figure 2, illustrating the application of two mercury tube switches, and with the operating shaft and mechanism carrier thereby omitted.

Figure 4 is an enlarged detailed top plan view, with parts broken away, of the adjusting mechanism.

Figure 5 is a view in front elevation of Figure 4.

Figure 6 is a fragmentary detailed view in section taken on the line 6—6 Figure 5.

Figure 7 is a detailed view in front elevation of the toothed disc shown in Figures 1 and 2.

Figure 8 is an enlarged detailed view of that end of the operating shaft which mounts the operating mechanism.

In the embodiment of this invention illustrated upon the accompanying drawings, the thermostatic element is illustrated as a helical coil 1 of bi-metallic material, one end of which is secured to a housing 2 adapted to be inserted through the duct or casing of a furnace or heater employing an electrically controlled oil burner mechanism. The housing 2 is preferably held in position in the hot air duct or casing by an adjustable clamping member 3 and it is preferable to extend the housing through this member to engage the rear wall of the switch mechanism casing 4. The other end of the helical coil 1 is rigidly secured to an operating shaft 5 which passes through a bearing 6 in the rear wall of the casing 4, the shaft passing through this bearing also passes through a shouldered spacing member 7. The end of the shaft 5 terminating within the casing 4 is provided with oppositely deposed parallel flat cut-away surfaces 8, as shown in Figure 8, and at this extremity is screw threaded, as at 9. A flanged sleeve 10 is keyed upon the flat surfaced portion of the shaft 5 and a toothed disc 11 is keyed upon the sleeve 10, as shown in Figure

6. A disc 12, of less diameter than the disc 11, is preferably mounted on the end of the shaft 5 and held in engagement with the disc 11 by a washer 13 and nut 14 upon the screw threaded portion 9 of the shaft 5. The flanged sleeve 10 engages the spacing member 7 and is provided with an outstanding circular flange 15. Two plates 16 and 17 are rotatively mounted upon the sleeve 10 and are held against the flange 15 by a sleeve 18 interposed between said plates and the shoulder of the spacing member 7. The plates 16 and 17 are each provided with radial extensions 19, as shown in Figure 5, the extensions 19 of the plates 16 and 17 are provided with adjacent substantially radial edges with angular portions extending away therefrom. The ends of these angular portions opposite the respective radial edges are each provided with anchors 20 for engaging the opposite ends of a coil spring 21, the tension of which is sufficient to normally maintain the radial edges adjacent each other.

One or more mercury tube switches 22 are secured by clips 23 to a carrying arm 24 bent at right angles to a switch operating plate 25 which is pivotally mounted upon the pivot pin 26, mounted in the bearing 27 secured to the rear wall of the casing 4 and a bearing plate 28, held in spaced relation to the rear wall of the casing 4 by the posts 29, which also serve as stops limiting the movement of the operating plate 25 in either direction. An operating arm 30 is secured to the switch carrying plate 25 above its pivot 26 and held in parallel relation to said pivot by the plate 31 mounted thereon between the bearing plate 28 and switch carrier plate 25. The operating arm 30 extends beyond the bearing plate 28, passing over a cut away portion thereof, and terminating in a downwardly extending finger or indicator 31^1 in advance of the toothed disc 11, said finger or indicator providing means of showing the actual temperature of the furnace or heater in which the device is installed.

The radial extensions 19 are of such proportions that the radial edges thereof may be brought into engagement with the switch operating arm 30. Between the toothed disc 11 and flange 15 two plates 32 and 32^1 are loosely mounted upon the sleeve 10. These plates are each provided with upwardly extending portions and each provided with bent down finger 33 adapted to engage in the teeth of the toothed disc 11, that portion of the plate directly below the toothed finger is provided with a bent back portion 34 adapted to pass between the radial edges of the extensions 19 of the plates 16 and 17, and that portion of the plate next above the finger is bent outwardly over the circumference of the toothed disc and then downwardly parallel to the surface of said disc and terminated in pointers 35, the edges of which are in line with the bent back portions 34 and each of these pointers are adapted to pass over the plate 12, as shown in Figure 2.

The fingers 33 are slidable over the toothed disc 11 and will normally hold the plates 32 and 32^1 of the fingers in contact with the toothed plate 11. The spring 21 of the radial extensions 19 of plates 16 and 17 will normally hold their respective radial edges against the backward extensions 34 of the finger carrying plates. The radial edges of the plates 19 upon rotation of the shaft 5 will, through the connection of the fingers 33 to the toothed disc 11 and portions 34, engage the switch operating arm 30 when the shaft 5 is rotated in one direction to move the arm 30 in that direction and tilt the switch carrying plate 28, thereby making or breaking, as the case may be, the circuit through the mercury tube 22, and when the shaft 5 is rotated in the opposite direction the radial extension 19 of the other plate will in the same manner engage the opposite side of the switch operating arm 30 and tilt the switch in the opposite direction. The fingers 33 may be manually moved to slide over the teeth of the disc 11 so that the relative relation of the radial edges of the plates 19 may be adjusted independently of each other and cause them to engage the opposite side of the switch operating shaft 30 as desired. The plate 12 on the outer side of the toothed disc 11 may be calibrated to display a temperature scale and, as seen in Figure 2, the pointers 35 are adapted to travel over such scale and by the proper manual adjustment of the fingers 33 upon the toothed disc 11 their respective radial extensions 19 may be so adjusted that the radial edges thereof upon rotation of the shaft 5 in one direction will engage the switch operating arm 30 and tilt the switch at a predetermined temperature and upon rotation in the opposite direction the other radial extension may be caused to engage the switch operating arm 30 at a predetermined temperature and tilt the switch in the opposite direction.

While Figure 2 illustrates a single mercury tube switch 22 it is obvious that two or more mercury tube switches might be supported as indicated in Figure 4. Figure 3 does illustrate two mercury tube switches mounted upon the switch carrying plate 25 tilted in one direction with a circuit closed in one switch and broken in the other, and it is obvious that when the switch carrying plate 25 is tilted in the opposite direction the closed circuit will be broken and the open circuit will be closed.

The fingers 33, while described as being slidable over the toothed disc 11 do not actually ride over the teeth of this disc but actually engage the teeth, when positioned, forming a lock between the finger carrying plates and toothed disc. The adjustment of the

fingers upon the toothed disc is performed by pressing the portion carrying the pointer 35 in the direction of the disc which will move the fingers out of engagement with the teeth so that the plates 32 and 32¹ may be rotated to the proper position and when the pressure is released upon the pointer 35 the resiliency of the plate will cause the fingers 33 to move forward and engage between two teeth of the disc. It is seen that by this construction an easy operable adjustment of the positions of the fingers is readily made and when the fingers are positioned the plates 32 and 32¹ are rigidly fixed to the toothed disc 11.

The coil spring 21 not only urges the abutment of the plates 16 and 17 toward the switch operating arm 30 but also allows a further movement of the operating shaft and toothed disc after the switch carrying plate has been tilted if the bi-metallic coil should expand or contract a greater degree than that required to tilt the switch plate, thereby preventing the possibility of the bi-metallic coil from taking a set.

What I claim is:

1. In a mercury switch mechanism, a thermal actuating member, an operating shaft actuated thereby, a tiltable switch carrying plate, means for tilting said plate, and means mounted upon the operating shaft for engaging said tilting means, and means for adjusting the time of said engagement.

2. In a switch operating mechanism, a thermal actuating member, a tiltable switch carrying plate, means upon the plate for tilting the same, an operating shaft actuated by the said thermal member, an operating disc fixed upon said shaft, adjustable abutments rotatably mounted upon said shaft adapted to engage the switch plate tilting means, and means for adjustably positioning and securing said abutments to said operating disc.

3. In a mercury tube switch operating mechanism, a tiltable mercury switch carrying plate, means thereon for tilting said plate, a thermal actuating member, an operating shaft actuated thereby, an operating disc secured thereon, abutment members rotatively mounted upon said shaft adapted to engage the switch plate tilting means, resilient means normally drawing said abutment members toward the tilting means, adjusting members rotatively mounted upon said shaft provided with means for engaging the abutment members and having means adapted to removably engage the operating disc, whereby said adjusting means may be manually positioned at predetermined points upon the operating disc and thereby position the abutment members to tilt the switch plate through the thermal actuating member at predetermined temperatures.

4. In a mercury tube switch operating mechanism, a tiltable mercury switch carrying plate, means thereon for tilting said plate, a thermal actuating member, an operating shaft actuated thereby, an operating disc secured thereon, abutment members rotatively mounted upon said shaft adapted to engage the switch plate tilting means, resilient means normally drawing said abutment members toward the tilting means, adjusting members rotatively mounted upon said shaft provided with means for engaging the abutment members and having means adapted to removably engage the operating disc, whereby said adjusting means may be manually positioned at predetermined points upon the operating disc and thereby position the abutment members to tilt the switch plate through the thermal actuating member at predetermined temperatures, said resilient means acting upon said abutment members providing means after the said abutment has tilted the switch plate to allow further movement of the operating shaft in the same direction.

5. In a mercury tube switch operating mechanism, a tiltable mercury switch carrying plate, means thereon for tilting said plate, a movable actuating member, an operating shaft actuated thereby, an operating disc secured thereon, abutment members rotatively mounted upon said shaft adapted to engage the switch plate tilting means, resilient means normally drawing said abutment members toward the tilting means, adjusting members rotatively mounted upon said shaft provided with means for engaging the abutment members and having means adapted to removably engage the operating disc, whereby said adjusting means may be manually positioned at predetermined points upon the operating disc and thereby position the abutment members to tilt the switch plate through the actuating member upon predetermined movements thereof, said resilient means acting upon said abutment members providing means after the said abutment has tilted the switch plate to allow further movement of the operating shaft in the same direction.

6. In a mercury tube switch operating mechanism, a tiltable mercury switch carrying plate, means thereon for tilting said plate, a thermal actuating member, an operating shaft actuated thereby, an operating disc secured thereon, a temperature scaled disc also fixed upon the said shaft, abutment members rotatively mounted upon said shaft adapted to be engaged to the switch plate tilting means, resilient means normally drawing said abutment members toward the tilting means, adjusting members rotatively mounted upon said shaft provided with means for engaging the abutment members and having means adapted to removably engage the operating disc and provided with pointers adapted to coact with the temperature sealed disc to indicate the temperature

to which the thermal actuating member is subjected, whereby said adjusting means may be manually positioned at predetermined temperatures indicated upon said temperature scaled disc and thereby position the abutment members to tilt the switch plate through the thermal actuating member at predetermined temperatures.

IRA E. McCABE.

MERCOID EXHIBIT XXX 4

F. A. KUNTZ.

HEATING AND VENTILATING SYSTEM.

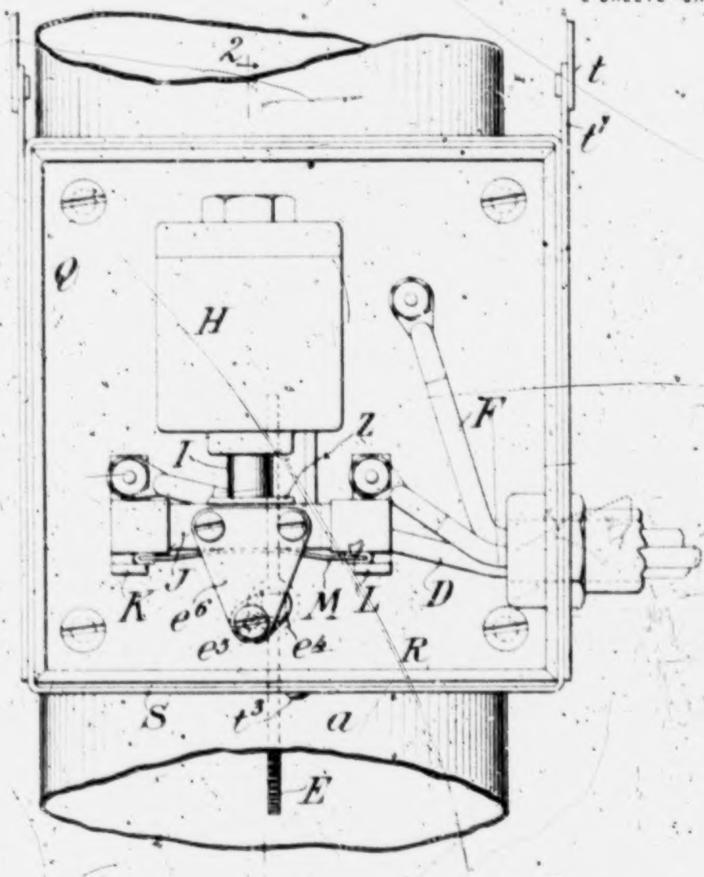
APPLICATION FILED AUG. 20, 1915.

1,193,271.

Patented Aug. 1, 1916.

2 SHEETS—SHEET 1.

Fig. 1.



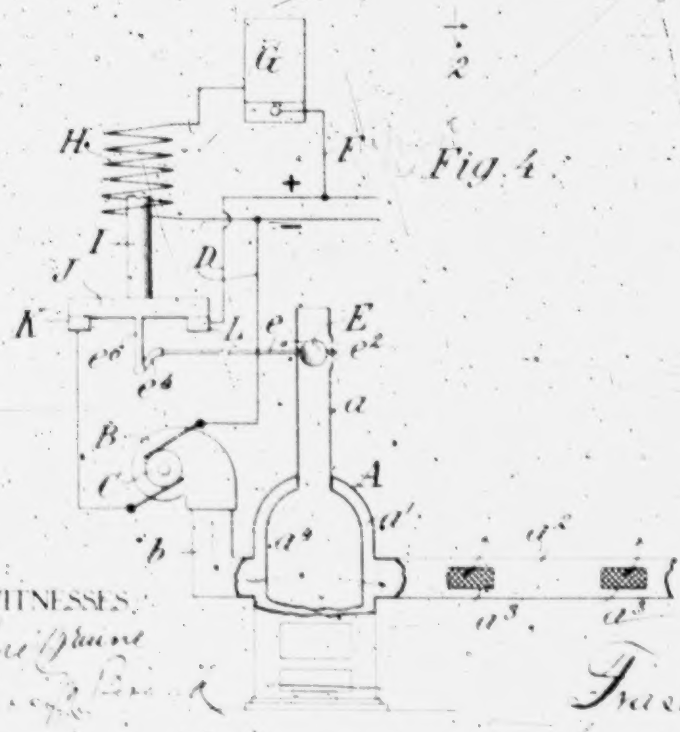


Fig. 4.

WITNESSES.

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HEATING AND VENTILATING SYSTEM.
APPLICATION FILED AUG. 20, 1915.

1,193,271.

Patented Aug. 1, 1916.
2 SHEETS—SHEET 2.

Fig. 2.

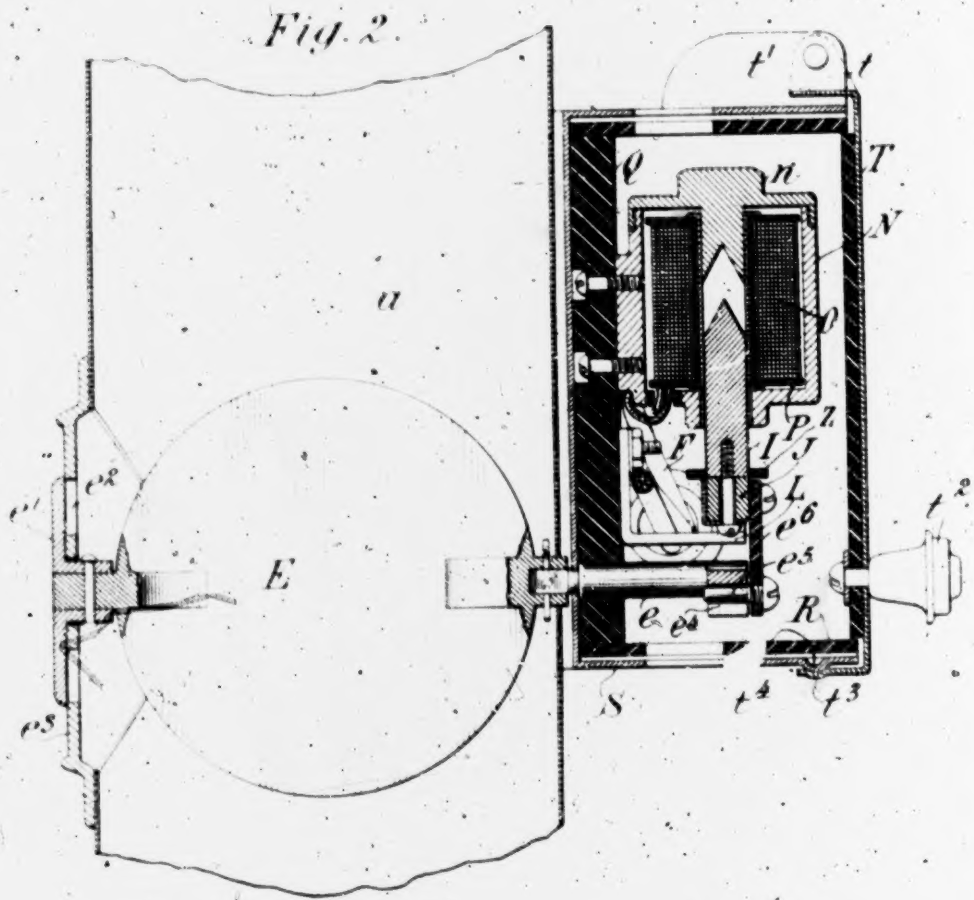
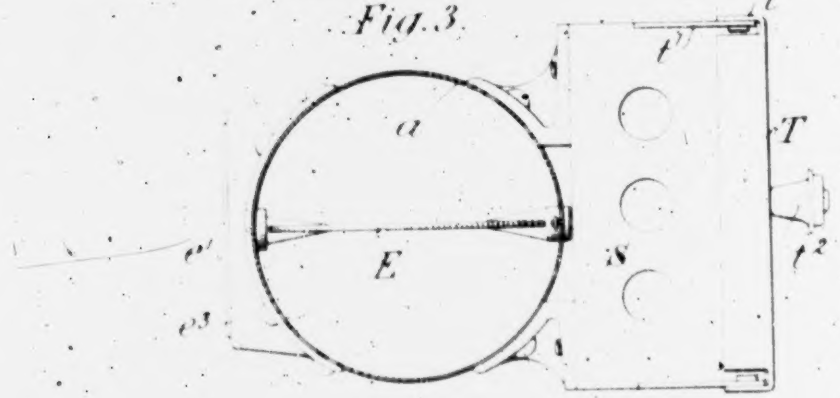


Fig. 3.



INVENTOR
Frank A. Kuntz,
By Attorneys,
Fraser Turk & Myers

WITNESSES

UNITED STATES PATENT OFFICE.

FRANK A. KUNTZ, OF NEW YORK, N. Y., ASSIGNOR TO GOLD CAR HEATING & LIGHTING COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

HEATING AND VENTILATING SYSTEM.

1,193,271. Specification of Letters Patent. Patented Aug. 1, 1916.

Application filed August 20, 1915. Serial No. 46,518.

To all whom it may concern:

Be it known that I, FRANK A. KUNTZ, a citizen of the United States, residing at Richmond Hill, borough of Queens, city and State of New York, have invented certain new and useful Improvements in Heating and Ventilating Systems, of which the following is a specification.

My invention relates to heating and ventilating systems and aims to provide improved means whereby the draft is regulated, and at the same time the supply of air to the air heating chamber of the heater is controlled.

A desirable form in which my invention may be embodied is illustrated in the accompanying drawings, wherein.

Figure 1 is a plan view of electromagnetic operating means used in connection with my system, partly broken. Fig. 2 is a section thereon on the line 2—2 of Fig. 1. Fig. 3 is a top view of Fig. 1, and Fig. 4 is a diagram illustrating one use of my invention.

According to my invention the heater A, which may be any heat producing furnace or stove, consuming fuel and therefore requiring a stack, is provided with a stack a, and has the usual heating chamber a^1 from which the heated air is conducted by conduits a^2 to the desired point, as, for instance, registers a^3. A centrifugal fan or blower B supplies air to the chamber a^1 through conduit b and is driven by an electric motor C. The electric motor C is included in a main electric circuit D. The stack a contains the usual damper E, and on the shaft e of this damper is a perforated disk e^1, the perforations in which are adapted to aline with similar perforations e^2 in a plate e^3 covering an opening in the side of the stack when the damper E is closed, and to close the openings e^2 when the damper is open.

Means are provided by me for simultaneously controlling the damper E and the blower B.

The controlling means are operated in a shunt circuit F, which includes a thermostat G. The particular type of thermostat forms no part of this invention, and is therefore not illustrated. Many types of thermostats appropriate for this purpose are known, and this thermostat is of a type adapted to be affected by the temperature of the apartment in which the same is contained, and to close the shunt circuit F when the temperature of the apartment rises sufficiently high, and to open the shunt circuit when the temperature drops below the desired point. In the shunt circuit is also contained an electromagnet, illustrated as a solenoid H, the construction of which is shown in detail in the sectional view, Fig. 2. The core I of this solenoid is attached to a bridge piece J, and this bridge piece is adapted to close the circuit between two contact jaws K and L in the main circuit D when the solenoid H is deenergized, and to break the said circuit when the solenoid is energized.

The shaft e of the damper E has a crank e^4 thereon which is connected by a connection e^6 to the bridge piece J. Suitable means are provided to enable the movement of the bridge piece J to turn the damper E, and such means take the form of a pin and slot connection e^5 between the said parts, as seen in Fig. 2, whereby the requisite lost motion is obtained.

I prefer to employ in connection with my heating and ventilating system the automatic switch illustrated in my application filed August 19, 1915, Serial No. 46,283, but the said switch is not claimed here, but is claimed in my said companion application. In the construction of the said switch the bridge piece J is formed of magnetic metal and is attached to the core I so as in effect to become a part thereof, and thereby the magnetic field is extended, and when the magnet is energized so as to lift the said bridge and break the main circuit D the said bridge piece acts as a magnetic blowout, and the lines of flux will extinguish or destroy the arcs which would otherwise exist between the bridge J and the contacts K and L. In connection with the said bridge I prefer to make contact with the contact jaws K, L by means of a phosphor-bronze brush M which has spring motion and gives the desired wiping contact when the circuit is closed.

The solenoid H is provided with a shell N which may be of cast iron, and has threaded thereon a cap n, the inner part of which acts as a part of the core I. The coil O is suitably connected to the wires of the shunt circuit F and is situated within a bobbin P which may be formed of fiber or bakelite. The solenoid is supported upon a backing of suitable insulating material, such as the slate plate Q. It is surrounded by an asbestos

lining R and is situated within a cabinet S, which may be formed of pressed steel and has a cover T having lugs t which are pivotally supported on corresponding ears t^1 on the side of the cabinet. This cover has a finger piece t^2 and is held in place by bosses t^3, t^3 on the cover and body respectively.

The core of the magnet is provided with a washer Z which, when the magnet is energized, acts as a stop by contacting with the shell N. This sudden stoppage of the core causes a violent vibration of the brush M, which assists in blowing out arcs that would otherwise exist between the bridge J and the contact jaws K, L.

The operation of my device is as follows: When the temperature in the apartment to be heated falls to a point indicating that more heat is desired, the thermostat G breaks the shunt circuit F; thereupon the core I drops and the bridge J makes contact with the contact jaws K, L, closing the main blower circuit D and starting the blower B and causing a current of fresh air to flow into the heater A and out through the registers a^3. At the same time the bridge J turns the damper E so as to open the same and cause a draft through the fuel chamber a^4, thereby heating the air which is supplied from the blower. When the apartment becomes sufficiently heated the thermostat J closes the shunt circuit F, whereupon the solenoid H is energized and the core I is lifted, breaking the motor circuit D and reversing the position of the damper E, and at the same time opening the stack vents e^1 e^2. When the core I is lifted the magnetic lines of flux then flowing will extinguish arcs which would otherwise be formed between the magnetic bridge J and the contact jaws K, L. The energizing of the magnet will have lifted the core I until the washer Z strikes the shell N, which it does with a sudden blow, causing violent vibrations of the brush M, and these vibrations assist in fanning or slapping out the said arcs.

I prefer to construct the bridge of iron, and the contact jaws K, L may be made of copper.

The blower B may be of any approved construction, such as a centrifugal fan or blower; the solenoid H is preferred, although another form of electromagnet employing an armature might be used.

My invention is not limited to the particular means for operating the damper and blower illustrated, although I prefer such means, nor is the invention limited to the particular connections between the bridge and damper, as these details of construction may be changed within the limits of the appended claims.

What I claim is:—

1. In a heating and ventilating system, a stove, a stack therefor, a damper in the stack, a blower adapted to supply air to an air heating chamber in the stove, an electric motor for the blower, an operating circuit for said motor having separated contact jaws, a shunt circuit, a thermostatic controller therein affected by the temperature of the surrounding atmosphere, an electromagnet in said shunt, a bridge operatively connected to the moving part of the said electromagnet and adapted to engage said contacts and close the motor operating circuit, and an operating connection from said moving part to said damper, whereby when the thermostatic controller changes the condition of the shunt, the electromagnet is caused to correspondingly operate the blower and damper.

2. In a heating and ventilating system, a stove, a stack therefor, a damper in the stack, a blower adapted to supply air to an air heating chamber in the stove, an electric motor for the blower, an operating circuit for said motor having separated contact jaws, a shunt circuit, a thermostatic controller therein affected by the temperature of the surrounding atmosphere, an electromagnet in said shunt, a bridge of magnetic metal attached to the core of said electromagnet and adapted to engage said contacts and close the motor operating circuit, and an operating connection from said moving part to said damper, whereby when the thermostatic controller closes the shunt the magnet is energized and the bridge closes the damper and breaks the blower circuit and acts as a magnetic blowout to destroy arcs.

3. In a heating and ventilating system, a fuel consuming stove, a stack therefor, a draft regulator therein, means for supplying air to an air heating chamber in the stove, electric driving means therefor, a main circuit including said driving means, a bridge adapted to close said main circuit and having an operating connection to said damper, a shunt circuit, means for opening and closing the shunt, an electromagnet in the shunt, and an operating connection from the moving part of said electromagnet to said bridge.

4. In a heating and ventilating system, a fuel consuming stove, a stack therefor, a draft regulator therein, means for supplying air to an air heating chamber in the stove, electric driving means therefor, a main circuit including said driving means, a bridge made of magnetic metal and adapted to close said main circuit and having an operating connection to said damper, a shunt circuit, means for opening and closing the shunt, a solenoid in the shunt and a connection between the core thereof and said bridge whereby when said controlling means opens the shunt the magnet is deënergized

and the bridge opens the draft regulator and closes the main circuit, and when the controlling means closes the shunt the magnet is energized and the bridge closes the draft regulator and breaks the main circuit and at the same time blows out the arcs.

5. In a heating and ventilating system, a fuel consuming stove, a draft regulator therefor, means for supplying air to an air heating chamber therein, an electromagnetic device for controlling said air supplying means, a direct connection from a moving part of said electromagnetic device to said draft regulator, an electric circuit including said electromagnetic device, and a thermostat affected by the temperature of the apartment to be heated and adapted to control said circuit.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

FRANK A. KUNTZ.

Witnesses:
F. T. KITCHEN,
F. BARAS.

MERCOID EXHIBIT L

Feb. 4, 1941. J. S. BAKER 2,230,446

AUTOMATIC CONTROL SYSTEM FOR WARM AIR FURNACES

Filed July 16, 1934 4 Sheets-Sheet 1

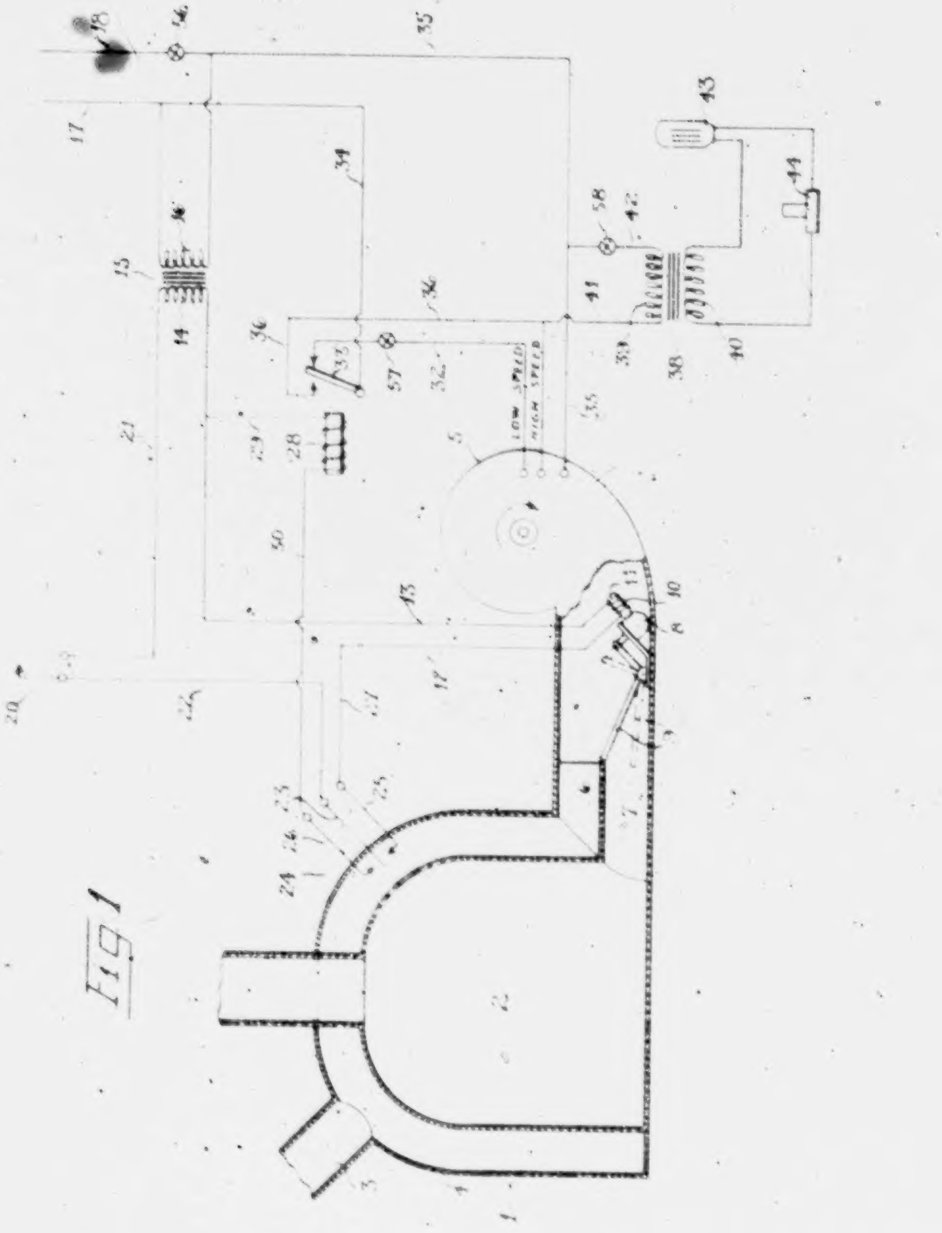


Fig 1

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Jones Addington Ames & Seibold
ATTYS

deenergized so that armature 90 will drop back to engage contact 95 of the low speed circuit of blower 5, which low speed circuit includes this contact 95, wire 96, blower 5 and wire 87.

Low speed operation of the blower will then occur if the temperature of the furnace is high enough to prevent the air being delivered by blower 5 from entering the room at a temperature chilling the room, say above the aforesaid low degree of 100° Fahr. Furnace switch 83 will be closed and the relay 85 will be energized. Energization of relay 85 attracts armature 93 into circuit closing position against contact 92. It will be observed, therefore, that the furnace control hereindisclosed functions practically at all times to keep the blower 5 in operation, either at high or at low speeds, in order to provide a continuous movement of heated air into the room.

In case the furnace is not fired by coal or other solid fuel but by liquid fuel, such as oil or gas, the damper controller 66 may be omitted and the relay 100 inserted in the circuit of room thermostat 60, such as I have illustrated diagrammatically in Fig. 6. Coil 101 of relay 100 is connected between wire 61 and 67. A combustion supporting device 102 employed in oil or gas fired furnaces, or which may be the oil or gas burner itself, is connected across the line by wires 103 and 104. If so desired, the burner 102 may be of the high and low flame type, having high and low flame circuits controlled by relay 100. The high flame circuit may include wire 105, contact 106, armature 107 of relay 100, wire 108, and device 102. The low flame circuit may include wire 109, contact 110, armature 107 of relay 100, wire 108 and device 102.

In the event the room thermostat 60 calls for heat and the furnace temperature has not exceeded a predetermined degree causing overheating of the furnace, current flowing through the circuit of the room thermostat will energize relay 100 and attract its armature into engagement with contact 106 of the high flame circuit of burner 102. The rate of combustion will be accelerated until the furnace temperature reaches a high point that will effect the opening of furnace switch 64 or, as the result of the increased combustion, permit the blower operating at high speed to deliver sufficient warm air to the room to raise the temperature and open room thermostat 60. When either of these two conditions obtain, the circuit of the room thermostat 60 is opened and armature 107 is allowed to drop into engagement with contact 110 of the low flame circuit of heater 102. The low flame of heater 102 will continue until there is a further demand for heat at the room thermostat 60.

Fig. 7 illustrates a heating system whether of the warm air type or otherwise similar to the heating systems shown in Figs. 5 and 6 except that the circuit of relay 78 is connected across the circuit of the room thermostat 60 in advance of the actuating coil 65 of damper controller 66. This arrangement provides for more frequent operations of the high speed of blower 5 without necessitating acceleration of combustion each time the blower is thus operated. A furnace switch 112 adapted to close when the temperature of the furnace exceeds a predetermined degree, say, exceeds 150° Fahr., is inserted in wire 76. Wires 76 and 79 of the circuit of relay 78 are connected across the circuit of room thermostat 60 in advance of the terminals of draft controller 66, so that the high speed circuit of blower 5 will be energized to operate blower 5 at high speed whenever the furnace temperature is above say 150° Fahr. I find that this arrangement affords a very efficient heating action of furnace 1 because more heat may be taken from the furnace with less acceleration of combustion.

The temperatures mentioned of thermostats 64, 83 and 112 are merely illustrative of satisfactorily operating ranges and may be varied without deviating from the principles of operation hereindisclosed.

Fig. 8 represents substantially the same heating system shown in Fig. 7 except that a liquid fuel burner is shown in lieu of a solid fuel burner. As in Fig. 6, a relay 100 is substituted in the circuit of room thermostat 60 in lieu of the actuating coil 65 of draft controller 66. However, in this arrangement, device 102 is not provided with a high and low flame circuit. Armature 107 of relay 100 is adapted to move into circuit engaging position against contact 115 when this relay 100 is energized. The circuit is completed across armature 107, contact 115, wire 116, heater 102 and wire 117. It will be understood, of course, that high and low flame circuits of device 102 shown in Fig. 6 may be provided in this instance, if found desirable, or that device 102 may be a combustion supporting device, such as a motor-driven blower or fan.

From the foregoing description, it will be understood that different parts of the system shown may be rearranged to meet existing conditions and demands for any particular installation without departing from the scope of the invention.

I broadly disclose employing a high and low speed motor that may be placed substantially into continuous operation either at high or at low speed so as to provide a continuous circulation of air from the furnace into the room, the amount of air being delivered depending upon the heating requirements of the demand for heat by room thermostat 60. I further broadly disclose controlling the substantially continuous operation of the blower 5 in accordance with the temperature of the furnace 1, this blower being arranged to operate substantially continuously between predetermined high and low furnace temperatures, whereby the blower will operate continuously at low speed when the temperature of the furnace is above said low degree but at high speed when the room thermostat calls for heat and closes its circuit to energize the combustion supporting means 66 or 102.

Without further elaboration, the foregoing will so fully explain the gist of my invention, that others may, by applying current knowledge, readily adopt the same for use under varying conditions of service, without eliminating certain features which may properly be said to constitute the essential items of novelty involved, which items are intended to be defined and secured to me by the following claims.

I claim:

1. In a heating system, a furnace including a warm air duct, means for producing a forced draft for said warm air duct, thermostatic apparatus in the room to be heated, thermostatic apparatus at said furnace, and means controlled by said thermostatic apparatus for directing the forced draft to said warm air duct or diverting a portion of the forced draft to the furnace to increase the rate of combustion.

2. In a heating system, a furnace including a warm air duct, a device for supplying air to said warm air duct and to said furnace to increase

the rate of combustion, electrically operated means for controlling the flow of the air supply to said warm air duct and to said furnace, thermostatic apparatus responsive to the heat produced by said furnace, thermostatic apparatus in the room to be heated and connections between said electrically operated means and said thermostatic apparatus by means of which said electrically operated means may conduct the air supply to said warm air duct or may divert a portion of the air supply to said furnace.

3. In a heating system, a furnace including a warm air duct, a device for supplying air to said warm air duct and to said furnace to increase the rate of combustion, an electrical circuit including a room thermostat and a furnace thermostat, and an electrically operated damper controller in said circuit for controlling the direction of flow of said air supply.

4. In a heating system, a furnace including a warm air duct, a device for supplying air to said warm air duct and to said furnace to increase its rate of combustion, a room thermostat responsive to heat produced by said furnace, a furnace thermostat responsive to the heat of said furnace, an electrically operated controller, and connections between said thermostats and said controller for controlling the direction of flow of the air supply.

5. In a heating system, a furnace including a warm air duct, a motor, a variable speed blower driven by said motor, said blower being connected to said warm air duct and to the fire box of said furnace, electrically operated means for controlling the flow of air circulated by said blower, an electrical circuit in which said means is disposed, and thermostatic apparatus in said electrical circuit by means of which said blower operates at different speeds and said electrically operated means operates to connect said blower either with said warm air duct and with the fire box of said furnace, or with said warm air duct alone.

6. In a heating system, a furnace including a warm air duct, a motor, a variable speed blower driven by said motor producing a forced draft for said warm air duct and the fire box of said furnace, an electrical circuit, thermostatic apparatus controlling said circuit, control means in said circuit operated by said thermostatic apparatus for varying the speed of said blower, and means in said circuit for controlling the feed of the forced draft whereby to direct said forced draft to said warm air duct or to divert at times a portion of said forced draft to said fire box, the feed of the forced draft to said fire box being at a reduced speed of said blower, the feed of the forced draft to said warm air duct being at a higher speed of said blower upon a predetermined rise of furnace temperature.

7. In a heating system, a furnace including a warm air duct, a motor, a high and low speed blower driven by said motor producing a forced draft for said warm air duct and for the fire box of said furnace, an electrical circuit, thermostatic apparatus controlling said circuit, means in said circuit for controlling the speed of said blower, and means in said circuit for closing the draft to said fire box when said blower operates at high speed and for opening the draft to said fire box when said blower operates at low speed.

8. In a heating system, a furnace including a warm air duct, a motor, a high and low speed blower driven by said motor producing a forced draft for said warm air duct and for the fire box of said furnace, an electrical circuit, thermostatic apparatus responsive to room and furnace temperatures controlling said circuit, control means in said circuit to operate said blower at high speed when the furnace temperature exceeds a predetermined degree, and means in said circuit for closing the draft to said fire box when said blower operates at high speed.

9. In a heating system, a furnace including a warm air duct, a motor, a high and low speed blower driven by said motor producing a draft for said warm air duct and a draft for the fire box of said furnace, an electric circuit in which said blower is connected, a room thermostat in said circuit, a furnace thermostat in said circuit, control means in said circuit to operate said blower at high and low speeds, and means in said circuit for controlling the draft to said warm air duct and to said furnace fire box according to the condition of said thermostat and the speed of said blower.

10. In a heating system, a furnace including a warm air duct, a high and low speed blower producing a draft for said warm air duct and a draft for the fire box of said furnace, an electric circuit in which said blower is connected, control means in said circuit to operate said blower at high and low speeds, electrically operated means for opening and closing the draft to said furnace fire box, a thermostat in said circuit influenced by the furnace temperature, and a second thermostat for closing said circuit upon a predetermined drop of room temperature whereby, if the furnace is at a predetermined low temperature, said control means will operate said blower at low speed and said draft operating means will open the draft to said furnace fire box, and, if the furnace is at a predetermined high temperature, said control means will operate said blower at high speed and said damper operating means will close the draft to said furnace fire box.

11. In a heating system, a furnace including a warm air duct, a blower producing a warm air circulation for said duct and a forced draft for the fire box of said furnace, a control device for varying the speed of said blower, a thermostat responsive to furnace temperature for operating said control device whereby the speed of said blower will be increased by an increased temperature or hot condition of said furnace and will be lowered by a decreased temperature or cold condition of said furnace, means also operating according to the condition of said furnace thermostat for directing the blower discharge either solely to said warm air duct or partly to said furnace fire box and partly to said warm air duct, and a thermostat responsive to room temperature for controlling said furnace thermostat.

12. In a heating system, a furnace including a warm air duct, a blower producing a warm air circulation for said duct and a forced draft for the fire box of said furnace, a control device for varying the speed of said blower, a thermostat responsive to furnace temperature for operating said control device whereby the speed of said blower will be increased by an increased temperature or hot condition of said furnace and will be lowered by a decreased temperature or cold condition of said furnace, means also operating according to the condition of said furnace thermostat for directing the blower discharge either solely to said warm air duct or partly to said furnace fire box and partly to said warm air duct, a thermostat responsive to room temperature for controlling said furnace ther-

mostat, and means controlled by the humidity of the air in the room for controlling the humidity of the air delivered by said blower to said warm air duct according to the temperature conditions of said furnace.

13. In a heating system, a furnace including a warm air duct, a blower producing a warm air circulation for said duct and a forced draft for the fire box of said furnace, a control device for varying the speed of said blower, a thermostat responsive to furnace temperature for operating said control device whereby the speed of said blower will be increased by an increased temperature or hot condition of said furnace and will be lowered by a decreased temperature or cold condition of said furnace, means also operating according to the condition of said furnace thermostat for directing the blower discharge either solely to said warm air duct or partly to said furnace fire box and partly to said warm air duct, a thermostat responsive to room temperature for controlling said furnace thermostat, and means operable upon an increased furnace temperature and the discontinuation of the draft to said furnace fire box for controlling the humidity of the air supplied by said blower to said warm air duct.

14. In a heating system, a furnace including a warm air duct, means for producing a warm air circulation for said duct and a forced draft for the fire box of said furnace, a control device for varying the rate of discharge of said air circulating means, a furnace thermostat influenced by a cold and a warm condition of said furnace, said furnace thermostat operating said control device whereby the rate of discharge of said air circulating means will be increased by a hot furnace condition to be supplied solely to said warm air duct and will be lowered by a cold furnace condition to be supplied as a forced draft to said furnace fire box, and means controlling the direction of flow of the air discharged by said air circulating means according to said hot or cold condition of said furnace.

15. In a heating system, a furnace including a warm air duct, means for producing a warm air circulation for said duct and a forced draft for the fire box of said furnace, a control device for varying the rate of discharge of said air circulating means, a furnace thermostat influenced by a cold and a warm condition of said furnace, said furnace thermostat operating said control device whereby the rate of discharge of said air circulating means will be increased by a hot furnace condition to be supplied solely to said warm air duct and will be lowered by a cold furnace condition to be supplied as a forced draft to said furnace fire box, means controlling the direction of flow of the air discharged by said air circulating means according to said hot or cold condition of said furnace, and means acting independently of said furnace thermostat for setting said control device in a position causing said air circulating means to operate at said increased rate temporarily and provide a continuous increased air supply to said duct.

16. In a heating system, a furnace including a warm air duct, electrically operated means for producing a warm air circulation for said duct and a forced draft for the fire box of said furnace, a thermostat responsive to room temperature for controlling the circuit of said air circulating means, an electrically operated controller in circuit with said room thermostat for controlling the flow of air produced by said air circulating means whereby to supply the air to said duct and to said furnace fire box, a relay in circuit with said air circulating means, a thermostat responsive to warm and cold conditions of said furnace and controlling said relay to control the rate of discharge of said air circulating means, and means operable at said room thermostat and in the circuit of said relay to effect a temporarily increased rate of discharge of said air circulating means independently of the operation of said furnace thermostat.

17. In a heating system, a furnace including a warm air duct, electrically operated means for producing a warm air circulation for said duct and a forced draft for the fire box of said furnace, a thermostat responsive to room temperature for controlling the circuit of said air circulating means, an electrically operated controller in circuit with said room thermostat for controlling the flow of air produced by said air circulating means whereby to supply the air to said duct and to said furnace fire box, a relay in circuit with said air circulating means, a thermostat responsive to warm and cold conditions of said furnace and controlling said relay to control the rate of discharge of said air circulating means, means operable at said room thermostat and in the circuit of said relay to effect a temporarily increased rate of discharge of said air circulating means independently of the operation of said furnace thermostat, and means in circuit with said relay and operable when said relay is energized to effect an increased rate of discharge of said air circulating means for controlling the humidity of the air delivered by said blower according to the humidity conditions of the air in the room.

18. In a heating system, a furnace including a warm air duct for furnishing heated air to a room to be heated, a thermostat responsive to temperature variations of said room, means for producing an air circulation, means controlled by said thermostat for diverting a portion of said air circulation to the furnace as a forced draft to increase the rate of combustion, means operable upon a predetermined rise of furnace temperature to increase the capacity of said air circulating means to provide increased air circulation to said air duct and to discontinue the operation of said diverting means, and means continuing the operation of said air circulating means at a decreased capacity upon a predetermined rise of room temperature to maintain a constant air circulation to said room while said room thermostat is satisfied to prevent air stratification in said room.

19. In a heating system, a furnace including a warm air duct, means for producing a forced draft to said air duct to provide a constant circulation of air to a room to be heated to prevent stratification of the air therein, a thermostat responsive to temperature variations of said room, means controlled by said thermostat to divert a portion of said forced draft to said furnace upon a predetermined drop of room temperature to increase the rate of combustion in said furnace, and means controlling said air circulating means to provide an increased forced draft upon a predetermined rise of furnace temperature until the heat of said room rises to a predetermined temperature whereby to restore said air circulating means to its original operating capacity of a constant circulation of air to said room to prevent air stratification therein.

20. In a heating system, the combination of

apparatus for controlling the rate of combustion and the rate of supply of a heat conducting medium, thermostatic apparatus responsive to furnace temperature and the temperature of the room to be heated, and means between said control apparatus and said thermostatic apparatus by means of which said control apparatus operates to supply said heat conducting medium between predetermined low and high furnace temperatures and to accelerate the rate of supply of said heat conducting medium and the rate of combustion below a predetermined room temperature.

21. In a heating system, the combination of apparatus for controlling the rate of supply of a heat conducting medium, thermostatic apparatus responsive to furnace temperature and the temperature of the room to be heated, and means between said control apparatus and said thermostatic apparatus by means of which said control apparatus operates to supply said heat conducting medium between predetermined low and high furnace temperatures and to accelerate the rate of said supply below a predetermined room temperature.

22. In a heating system, the combination of apparatus for controlling the rate of supply of a heat conducting medium, thermostatic apparatus responsive to furnace temperature, and means between said control apparatus and said thermostatic apparatus by means of which said control apparatus operates to supply said heat conducting medium between predetermined low and intermediate furnace temperatures and to accelerate the rate of said supply between said intermediate and a predetermined high furnace temperature.

23. In a heating system, the combination of apparatus for controlling the rate of supply of a heat conducting medium; thermostatic apparatus responsive to furnace temperature and the temperature of the room to be heated, and means between said control apparatus and said thermostatic apparatus by means of which said control apparatus operates to supply said heat conducting medium between predetermined low and intermediate furnace temperatures, to accelerate the rate of said supply between said intermediate and a predetermined high furnace temperature, and, irrespective of said intermediate furnace temperature, to accelerate the rate of said supply between said predetermined low and high furnace temperatures when said room tmperature drops below a predetermined degree.

24. In a heating system, a heater, an electrically operated device for controlling the rate of combustion at said heater, thermostat responsive to the temperature of the room to be heated, a thermostat responsive to a predetermined high temperature of said heater, a circuit including in series relation said combustion controlling device and said room and furnace thermostats, electrically operated means for controlling the rate of supply of a heat conducting medium, a two speed circuit for said medium controlling means, and connections between said circuits including a second furnace thermostat responsive to predetermined low furnace temperature by means of which said medium controlling means operates at low and high speeds to supply said heat conducting medium to the room to be heated according to furnace and room temperatures.

25. In a heating system, a heater, means for supplying a heat conducting medium at a predetermined rate to the room to be heated, a thermostat responsive to the temperature of the room, means controlled by said room thermostat to decrease said rate of supply of said heat conducting medium when said room thermostat calls for heat, and means controlled by the temperature of said heater and operable during the period said room thermostat is calling for heat for restoring the rate of supply of said heat conducting medium and for accelerating the same beyond said predetermined rate.

26. In a heating system, a heater, means for supplying a heat conducting medium at a predetermined rate to the room to be heated, a thermostat responsive to the temperature of the room, means controlled by said room thermostat to decrease said predetermined rate of supply of said heat conducting medium when said room thermostat calls for heat, means controlled by the temperature of said heater and operable during the period said room thermostat is calling for heat for restoring said predetermined rate of supply of said heat conducting medium and to accelerate the same beyond said predetermined rate, and means for discontinuing the supply of said heat conducting medium when the temperature of said heater drops below a predetermined low temperature.

27. In a heating system, a heater, means for supplying a forced circulation of a heat conducting medium at a predetermined rate to the room to be heated, a room thermostat responsive to the temperature of the room, and control means responsive to the temperature of said heater for said supply means whereby said heat conducting medium will be supplied at said predetermined rate when said room thermostat is satisfied and will be supplied at an increased rate when said room thermostat calls for heat and said heater is above a predetermined temperature.

28. In a heating system, a heater, means for supplying a heat conducting medium at a predetermined rate to the room to be heated, a room thermostat responsive to the temperature of the room, control means responsive to the temperature of said heater for said supply means whereby said heat conducting medium will be supplied at a predetermined rate when said room thermostat is satisfied and will be supplied at an increased rate when said room thermostat calls for heat, and means operable when said heat conducting medium is supplied at said increased rate for controlling the humidity of the air in the room.

29. In a heating system, a heater, a multi-speed blower for supplying a heat conducting medium from said heater to a room to be heated, a thermostat responsive to the temperature of the room, and means including a thermostat responsive to the temperature of said heater and controlled by said room thermostat for controlling said multi-speed blower whereby to operate said multi-speed blower at a predetermined rate or at an accelerated rate.

30. In a heating system, a heater, a multi-speed blower for supplying a heat conducting medium from said heater to a room to be heated, a thermostat responsive to the temperature of the room, means including a thermostat responsive to the temperature of said heater and controlled by said room thermostat for controlling said multi-speed blower whereby to operate said multi-speed blower at a predetermined rate or at an accelerated rate, and means operable when said heat conducting medium is sup-

plied at said accelerated rate for controlling the humidity of the air in the room.

31. In a temperature controlling system, a heater, multi-speed circulating means for supplying a forced circulation of a heat conducting medium at different rates of flow from said heater to a room to be heated, a thermostat responsive to the temperature of the room, control mechanism associated with said room thermostat and controlling said circulating means at different speeds whereby to supply said heat conducting medium at different rates of flow to maintain the room substantially at a predetermined heated temperature, and means associated with said control mechanism for actuating said circulating means when the temperature of the room exceeds a predetermined temperature whereby to supply said medium at an unheated temperature to the room to maintain the room at a predetermined cool temperature.

32. In a temperature controlling system, a heater, means for supplying a heat conducting medium from said heater to a room to be heated, a thermostat responsive to the temperature of the room in circuit with said supply means, means responsive to the temperature of said heater and in circuit with said supply means and said room thermostat by means of which said heat conducting medium will be supplied at a predetermined rate when the temperature of said heater is at predetermined low temperature but will be supplied at an accelerated rate when the temperature of said heater rises above said predetermined low temperature, and means in circuit with said room thermostat and said heater responsive means for disabling the operation of said supply means at said predetermined rate but continuing the operation of said supply means at said accelerated rate whereby to supply said heat conducting medium as a cooling medium to the room when the temperature of the room exceeds a predetermined high temperature.

33. In a heating system, a heater, high or low rate combustion producing means for said heater, means for supplying a heat conducting medium from said heater at different rates to a room to be heated, a thermostat responsive to the temperature of the room, a thermostat responsive to the temperature of said heater, and control devices for said combustion producing means and said supply means associated with said thermostats whereby said combustion producing means may operate at a predetermined low or high rate, and said supply means may operate at a predetermined normal or accelerated rate, the rate of operation of said combustion producing means being controlled by predetermined room temperatures and the rate of operation of said supply means being controlled by predetermined furnace temperatures.

34. In a heating system, a furnace, a high and low speed blower to provide a circulation of air to a room to be heated, a thermostat responsive to the temperature variations of said room, a thermostat responsive to the temperature variations of said furnace, and connections between said blower and said furnace thermostat for controlling the operation of said blower at high speed above a predetermined furnace temperature and at low speed below said predetermined furnace temperature.

35. In a furnace control, the combination of apparatus of variable capacity for controlling the rate of supply of a heat conducting medium to a room to be heated, thermostatic apparatus responsive to furnace temperature and to room temperature, and connections between said control apparatus and said thermostatic apparatus by means of which said control apparatus operates at different capacities to supply the heat conducting medium to said room, said furnace thermostatic apparatus operating said control apparatus to supply the heat conducting medium at one capacity below a predetermined furnace temperature and at another capacity above said predetermined furnace temperature.

36. In a system of the class described, means for supplying a heat transfer medium to a room, a control device for operating said supply means to supply said heat transfer medium at a predetermined rate or at an accelerated rate, a thermostat responsive to the temperature of the room for controlling the operation of said control device, a heater for said heat transfer medium, a thermostat responsive to the temperature of said heater, and mechanism for placing said control device under the operation of said furnace thermostat when said heater is functioning to heat said heat transfer medium or under the operation of said room thermostat when said heater is not functioning and the heat transfer medium is used as a cooling medium for the room.

37. In a system of the class described, means for supplying a heat transfer medium to a room, control means for operating said supply means to supply said heat transfer medium at a predetermined rate and at an accelerated rate, thermostatic apparatus responsive to the temperature of the room for effecting operation of said supply means, a heater for said heat transfer medium, means for controlling the operation of said heater, and thermostatic apparatus responsive to the temperature of said heater for controlling the operation of said control means whereby to supply said heat transfer medium at said predetermined rate and at said accelerated rate according to predetermined heater conditions, said heater thermostatic apparatus having provisions for controlling the operation of said heater control means according to heater conditions independent of the heater conditions controlling the operation of said supply means.

38. A temperature control system of the class described, comprising, in combination, a circulator for circulating a fluid medium to a space the temperature of which it is desired to control, means responsive to the temperature of the fluid medium for operating said circulator at a low speed whenever the temperature of the fluid medium is at a given value, and means responsive to the temperature of the space for operating said circulator at a higher speed when the space temperature diverges from a predetermined value.

39. In a temperature control system, an electrically operated circulator for circulating a fluid medium, a switch responsive to the temperature of the fluid medium, circuit connections controlled by said switch for operating said circulator at one speed when said switch is closed, a thermostatic switch responsive to a temperature condition other than that of the circulating medium, and circuit connections for operating said circulator at another speed when both said switches are closed.

40. The combination with a warm air furnace and an electrically operated circulator for circulating the air heated thereby, of means in control of the supply of heat to said air, a switch

responsive to the temperature of said air and closed when the temperature thereof is above a predetermined minimum value, a circuit for operating said circulator at low speed controlled by said switch, a room thermostat, and connections between said room thermostat, heat supply controlling means and circulator for increasing the supply of heat to said air and for operating said circulator at a higher speed when the room temperature falls below a predetermined value.

41. A temperature control system of the class described, comprising in combination, circulation controlling means in control of the flow of a fluid medium for changing the temperature of a space, means responsive to the temperature of the fluid medium to operate the circulation controlling means to produce a predetermined flow of fluid whenever the temperature of the fluid medium is at a given value, and space temperature-responsive means to operate the circulation controlling means to produce a different flow of fluid when the space temperature is at a given value, said fluid medium temperature responsive means preventing operation of the circulation controlling means by the space temperature responsive means if the temperature of the fluid medium is not at said given value.

42. In a system for heating and humidifying a space to be controlled, in combination, means to deliver air to the space, means to heat said air, means to add moisture to the air, means responsive to the humidity of the space in control of said moisture adding means, means responsive to the temperature of the air in control of the air circulating means to increase the circulation of air to the space and to permit control of the moisture adding means by the humidity responsive control only when the temperature of the air is sufficiently high, and means responsive to the temperature of the space in control of the means to heat the air to raise the temperature thereof when the temperature of the space becomes too low.

43. In combination, a heater for heating air delivered to a space, electrical means in control of the heater, a space thermostat in control of said heater controlling means to increase the heating of the air when the space temperature becomes too low, electrical means to circulate the heated air to the space, an air temperature responsive switch in control thereof to increase the circulation of air to the space when the temperature of the air becomes sufficiently high, electrical means to add moisture to the air, a space humidity responsive switch, and circuit connections controlled by the conjoint action of said switches in control of said electrical moisture adding means.

44. In a temperature controlling system, a heater, multi-speed circulating means for supplying a forced circulation of a fluid medium from said heater to a room to be heated, a thermostat responsive to the temperature of the room, control mechanism controlled by said thermostat and operating said circulating means at high speed upon a drop of room temperature to a predetermined point and at low speed upon a rise of room temperature to a predetermined point, and means for reversing the action of the parts for causing said circulating means to operate at high speed upon a rise of room temperature to a predetermined point and at low speed upon a drop of room temperature to a predetermined point.

45. In a temperature control system of the class described, a heater, a multi-capacity blower device operable at low and high speeds for circulating a fluid medium heated thereby, an electrically operated control device adapted when deenergized for operating said blower device at low speed, a thermostatic switch responsive to the temperature of the fluid medium, a second thermostat switch responsive to room temperature, and circuit connections energizing said control device to operate said blower device at high speed when both said thermostatic switches are closed.

46. In a temperature control system of the class described, a heater, multi-speed circulating means operable at low and high speeds for circulating a fluid medium heated thereby, an electrically operated control device having low and high speed contacts in circuit with said circulating means, a thermostat responsive to room temperature, a thermostat responsive to the temperature of said fluid medium, and circuit connections for energizing said control device to close said high speed contact and to operate said circulating means at high speed when both said thermostats are actuated.

47. In a temperature control system of the class described, a heater, multi-speed circulating means operable at low and high speeds for circulating a fluid medium heated thereby, a control circuit for said circulating means having low and high speed contacts, a control device for closing said low speed contact when deenergized and for closing said high speed contact when energized, a thermostat responsive to the temperature of the fluid medium adapted to close at a predetermined temperature of said fluid medium, and a thermostat responsive to room temperature, the closing of said room thermostat energizing said control device to operate said circulating means at high speed when said fluid responsive thermostat is closed, the opening of said room thermostat deenergizing said control device to operate said circulating means at low speed when said fluid responsive thermostat is closed.

48. In a temperature control system of the class described, a heater, multi-speed circulating means operable at low and high speeds for circulating a fluid medium heated thereby, low and high speed contacts for said circulating means, a relay, a switch arm for closing said low speed contact when said relay is deenergized and for closing said high speed contact when said relay is energized, a thermostat responsive to the temperature of the fluid medium adapted to close at a predetermined temperature of the fluid medium, and a second thermostat responsive to room temperature adapted to close upon a predetermined drop of room temperature to energize said relay and to close said high speed contact.

49. In a heating system, a heater, combustion producing means for said heater, means for circulating a heat conducting medium from said heater to a room to be heated, a thermostat responsive to the temperature of the room for controlling the operation of both said means, a thermostat responsive to a predetermined high temperature of said heater and in circuit with said room thermostat for controlling the operation of said combustion producing means whereby to check or to accelerate the rate of combustion at said heater, and means also controlled by the thermostat of said heater for controlling the operation of said circulating means whereby to circulate said heat conducting medium at a

predetermined rate of flow or at an accelerated rate of flow.

50. A summer-winter control system of the class described, in combination, a heat increasing means for heating a fluid medium to be circulated to a space to be heated, a low and high speed circulator for circulating said fluid medium at different rates of flow, a space thermostat for operating said heat increasing means and for operating said circulator at high speed upon a drop of space temperature in the winter, thermostatic apparatus responsive to the temperature of the fluid medium controlling the operation of said space thermostat, said thermostatic apparatus discontinuing the control of said space thermostat over said circulator upon a drop of temperature of the fluid medium to a predetermined point and preventing the operation of said heat increasing means by said space thermostat to increase the temperature of the fluid medium when the temperature thereof is above a predetermined value, and mechanism for changing the arrangement of the parts in such a manner as to cause operation of said circulator at low speed during normal space temperatures in the summer and to cause operation of said circulator at high speed in the summer when the space temperature becomes too high, said mechanism including means for changing the operative relation of said thermostatic apparatus with respect to said space thermostat so that said heat increasing means cannot be operated by said space thermostat and said circulator may always be operated by said space thermostat irrespective of normal fluctuations in the temperature of the fluid medium.

51. A summer-winter control system of the class described, in combination, a heater for heating a fluid medium to be circulated to a space to be heated, high and low speed circulating means for circulating said fluid medium at different rates of flow, a space thermostat and a thermostat responsive to the temperature of the fluid medium for controlling the operation of said high and low speed circulating means in the winter, and mechanism for changing the arrangement of the parts in such a manner as to cause high speed operation only in the summer when the space temperature becomes too high, said mechanism including means for changing the operative relation of said fluid medium thermostat with respect to the remaining parts so that said circulating means may always be operated by said space thermostat and for disconnecting the low speed operation of said circulating means.

52. A summer-winter control system of the class described, in combination, a heater for heating a fluid medium to be circulated to a space to be heated, high and low speed circulating means for circulating said fluid medium at different rates of flow, a space thermostat for operating said circulating means at high speed upon a fall of space temperature in the winter and at low speed upon a rise of space temperature in the winter, thermostatic apparatus for controlling the operation of said space thermostat in accordance with temperature fluctuations of the heating medium at said heater, and mechanism for changing the arrangement of the parts in such a manner as to cause high speed operation of said circulating means upon a rise of temperature in the summer and low speed operation of said circulating means upon a drop of temperature in the summer, said mechanism including means for changing said thermostatic apparatus from operative control of said space thermostat so that said circulating means may always be operated by said space thermostat irrespective of the temperature fluctuations of the fluid medium.

53. In a temperature controlling system, a heater, means for supplying a heat conducting medium from said heater to a room to be heated, a thermostat responsive to the temperature of the room for controlling said supply means, means responsive to the temperature of said heater and associated with said supply means and said room thermostat by means of which said heat conducting medium will be supplied at a predetermined rate when the temperature of said heater is at predetermined low temperature but will be supplied at an accelerated rate when the temperature of said heater rises above said predetermined low temperature, and means associated with said room thermostat and said heater responsive means for disabling the operation of said supply means at said predetermined rate but continuing the operation of said supply means at said accelerated rate whereby to supply said heat conducting medium as a cooling medium to the room when the temperature of the room exceeds a predetermined high temperature.

54. In a heating system, a heater, a thermostat responsive to the temperature of said heater, a thermostat responsive to the temperature of a room, and multi-capacity circulating means for supplying a heating medium from said heater to said room, the capacity of said multi-capacity circulating means being controlled by said heater and room thermostats.

55. In a heating system, a heater, means for supplying a forced circulation of a heat conducting medium at a predetermined rate to the room to be heated, a thermostat responsive to the temperature of the room, means controlled by said room thermostat to increase said rate of supply of said heat conducting medium when said room thermostat calls for heat, and means controlled by the temperature of said heater and operable during the period said thermostat is calling for heat for restoring the said predetermined rate of supply of said heat conducting medium.

56. In a heating system, a heater, means for supplying a forced circulation of a heat conducting medium at a predetermined rate to the room to be heated, a thermostat responsive to the temperature of the room, means controlled by the temperature of said heater to increase said predetermined rate of supply of said heat conducting medium when said room thermostat calls for heat, said means also being operable during the period said room thermostat is calling for heat for restoring said predetermined rate of supply of said heat conducting medium or again to increase the same beyond said predetermined rate, and means for discontinuing the supply of said heat conducting medium when the temperature of said heater drops below a predetermined low temperature.

57. In a temperature controlling system, a heat increasing means, a circulation controlling device for the fluid heated by said heat increasing means, a room thermostat responsive to the temperature of the room, connections between said room thermostat and said heat increasing means for causing heating of the fluid upon a fall in room temperature and for preventing such heating thereof when the room temperature has been restored, and means responsive to the temperature of the circulating fluid for causing circulation of the fluid upon a rise in temperature thereof to a pre-

determined point and continuing such circulation thereof irrespective of the temperature of the room or condition of said room thermostat as long as the temperature of the fluid is above said predetermined point.

58. In a heating system, a heater, heat increasing means for supplying heat to said heater to heat a circulating medium, circulating means for causing a forced circulation of said circulating medium to a space to be heated, a thermostat responsive to the temperature of said space for operating said heat increasing means to increase the temperature of said heater upon a fail of space temperature; thermostatic apparatus responsive to temperature of said heater for preventing the operation of said heat increasing means if the temperature of said heater is above a predetermined maximum, and thermostatic apparatus also responsive to the temperature of said heater for operating said circulating means when the temperature of said heater is above a predetermined value, said circulating means operating to circulate said medium above said maximum heater temperature irrespective of the condition of said space thermostat.

59. In a heating system, a heater, heat increasing means for supplying heat to said heater to heat a circulating medium, circulating means for causing a forced circulation of said circulating medium to a space to be heated, and thermostatic apparatus responsive to heater and space temperatures for operating said circulating means when the temperature of said heater is above a predetermined value and for operating said heat increasing means upon a drop of space temperature below a predetermined value but to prevent such operation of the heat increasing means above a predetermined high heater temperature, said thermostatic apparatus operating said circulating means above said predetermined high heater temperature.

60. In a heating system, a heater, heat increasing means for supplying heat to said heater to heat a circulating medium, circulating means for causing a forced circulation of said circulating medium to a space to be heated, and thermostatic apparatus including connections between said thermostatic apparatus and said circulating means by means of which said circulating means is prevented from operating whenever the temperature of the circulating medium is too low, is operated at low speed whenever the temperature of the fluid medium is at or above a predetermined value and the space to be heated is at or above a predetermined temperature, is operated at high speed when the fluid medium is at or above said predetermined value but the space is below said predetermined temperature, and is operated at high speed whenever the space is at or above said predetermined temperature but the temperature of the fluid medium is excessive.

61. In a heating system, a heater, heat increasing means of different operating capacities for supplying heat to said heater to heat a circulating medium, circulating means for causing a forced circulation of said circulating medium to a space to be heated, connections for causing operation of said heat increasing means at a low capacity to supply minimum heat to said circulating medium above a predetermined temperature of said space to be heated, thermostatic apparatus responsive to the temperature of said circulating medium for causing operation of said circulating means to effect a forced circulation thereof above a predetermined temperature thereof, and thermostatic apparatus responsive to the temperature of said space to be heated for causing operation of said heat increasing means at a higher capacity to supply additional heat to said circulating medium upon a drop of temperature below said predetermined temperature of said space.

62. In a heating system, a heater for heating a circulating medium, conducting means for permitting circulation of said circulating medium for heating a space, circulating means for causing forced circulation of said circulating medium through said conducting means, means for maintaining at all times a predetermined heater temperature whereby slow circulation of the circulating medium through the conducting medium is caused, means responsive to space temperature to increase the heater temperature when the space temperature falls below a predetermined value, and means responsive to heater temperatures to operate said circulating means when the heater temperature reaches a value above a predetermined temperature whereby forced circulation of the circulating medium through said conducting means is provided to heat said space.

63. In a heating system, a heater for heating a circulating medium, conducting means for permitting circulation of said circulating medium for heating a space, circulating means for causing forced circulation of said circulating medium through said conducting means, means for maintaining at all times a predetermined heater temperature whereby slow circulation of the circulating medium through the conducting medium is caused, means responsive to space temperature to increase the heater temperature when the space temperature falls below a predetermined value, means responsive to heater temperature to operate said circulating means when the heater temperature reaches a value above a predetermined temperature whereby forced circulation of the circulating medium through said conducting means is provided to heat said space, and means responsive to a predetermined high heater temperature for rendering said heater temperature increasing means inoperative but permitting operation of said circulating means.

64. In a heating system, a heater for heating a circulating medium, conducting means for permitting circulation of said circulating means for heating a space, circulating means for causing forced circulation of said circulating medium through said conducting means, low and high flame means for controlling the temperature of said heater, means to operate said low and high flame means for maintaining at all times a predetermined heater temperature whereby slow circulation of the circulating medium is caused, means responsive to space temperatures to operate said low and high flame means to increase the heater temperature when the space temperature falls below a predetermined value, and means responsive to heater temperature to operate said circulating means when the heater temperature reaches a predetermined temperature value whereby forced circulation of the circulating medium through said conducting means is provided to heat said space.

65. A heating system including a furnace comprising, in combination, means for increasing the rate of combustion, means for circulating a heat conducting medium heated by said combustion increasing means, thermostatic apparatus responsive to room temperature, thermostatic apparatus responsive to furnace temperature, connections between said combustion increasing

means and said room and furnace thermostatic apparatus for operating said combustion increasing means to supply heat to said medium upon a predetermined drop of room temperature and for preventing such operation when the furnace temperature is at or above a predetermined high limit, and connections between said medium circulating means and said furnace thermostatic apparatus for operating said medium circulating means to circulate said medium during normal operating temperatures of the furnace and continuing without interruption beyond normal high temperature of the furnace whereby said medium is continuously supplied to the room to maintain constant circulation of the heater air therein.

66. In a furnace control, the combination of a variable speed blower for controlling the rate of supply of a heat conducting medium to a room to be heated, furnace and room thermostatic apparatus responsive to furnace and room temperatures, and means controlled by said thermostatic apparatus for operating said blower at different speeds according to predetermined furnace and room temperatures and for continuing operation of said blower at one of said speeds when said room thermostat is ineffective.

67. In a heating system, the combination with a heater, of combustion producing means for said heater, a thermostat responsive to temperature of a room to be heated, a thermostat responsive to the temperature of said heater, connections between said combustion producing means and both said thermostats for operating said combustion producing means below a predetermined furnace temperature when said room thermostat is actuated by a drop of room temperature below a predetermined degree, means for circulating a heat conducting medium from said heater to the room, connections between said circulating means and said room thermostat for operating said circulating means whereby said heating conducting medium will be supplied to the room at a predetermined volume, and control means associated with said connections and said room thermostat for causing said circulating means to continue operating after said room thermostat is satisfied by a rise of temperature above said predetermined degree whereby said heat conducting medium will be supplied at a reduced volume to the room as long as said room thermostat remains satisfied.

68. A heating circulating system comprising, a heater, a circulating system for conducting a heating medium from said heater to a space to be heated, means for inducing circulation of said heating medium in said circulating system, means for automatically causing operation or cessation of said circulation inducing means when said heater is above or below, respectively, a predetermined temperature, and means for automatically varying the delivery capacity of said circulation inducing means responsive to temperature changes in the space to be heated.

JOHN S. BAKER.

Feb. 4, 1941. J. S. BAKER 2,230,446

AUTOMATIC CONTROL SYSTEM FOR WARM AIR FURNACES

Filed July 16, 1934 4 Sheets-Sheet 2

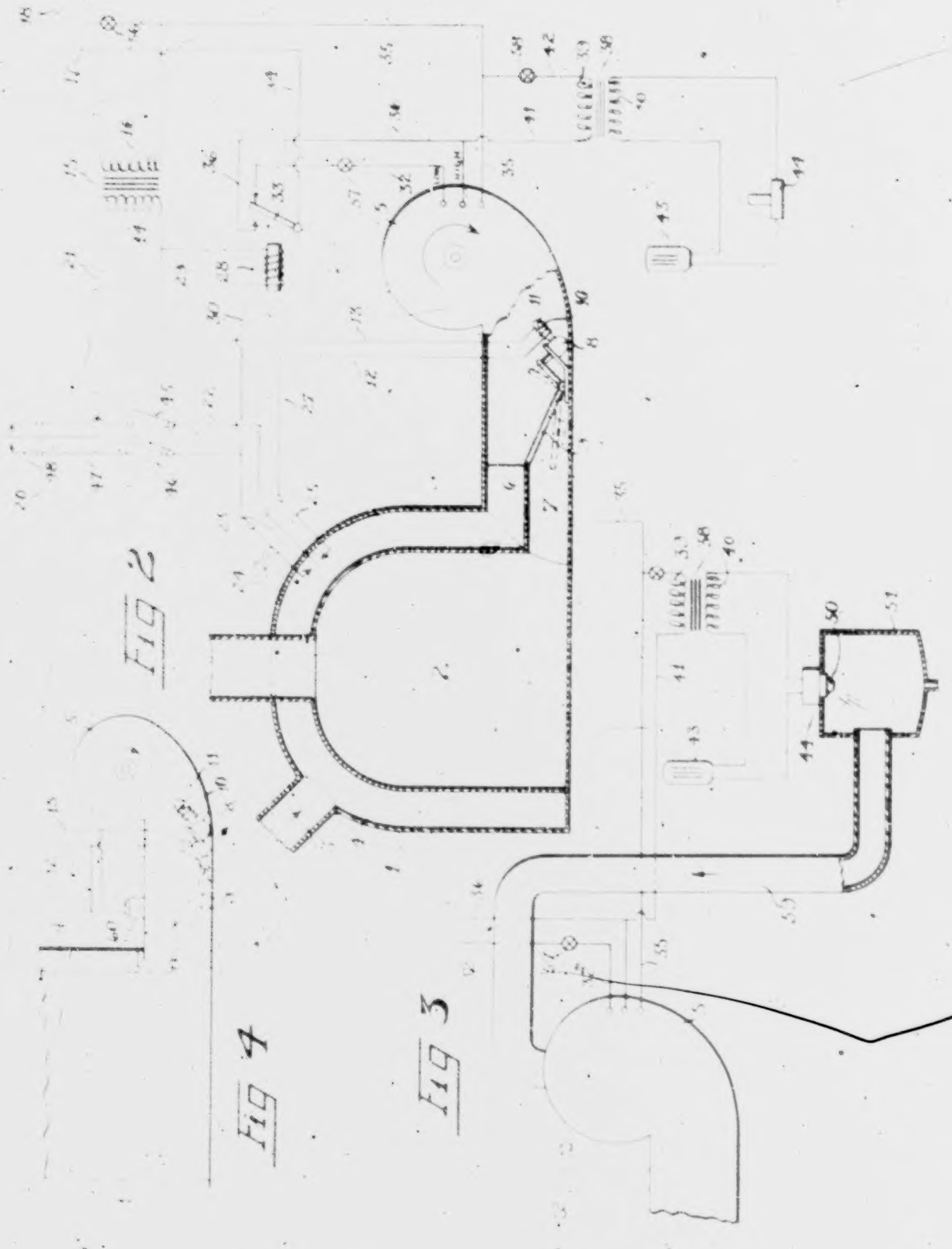

Fig 2

Fig 3

Fig 4

INVENTOR
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ATTYS

Feb. 4, 1941. J. S. BAKER 2,230,446

AUTOMATIC CONTROL SYSTEM FOR WARM AIR FURNACES

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Fig. 5

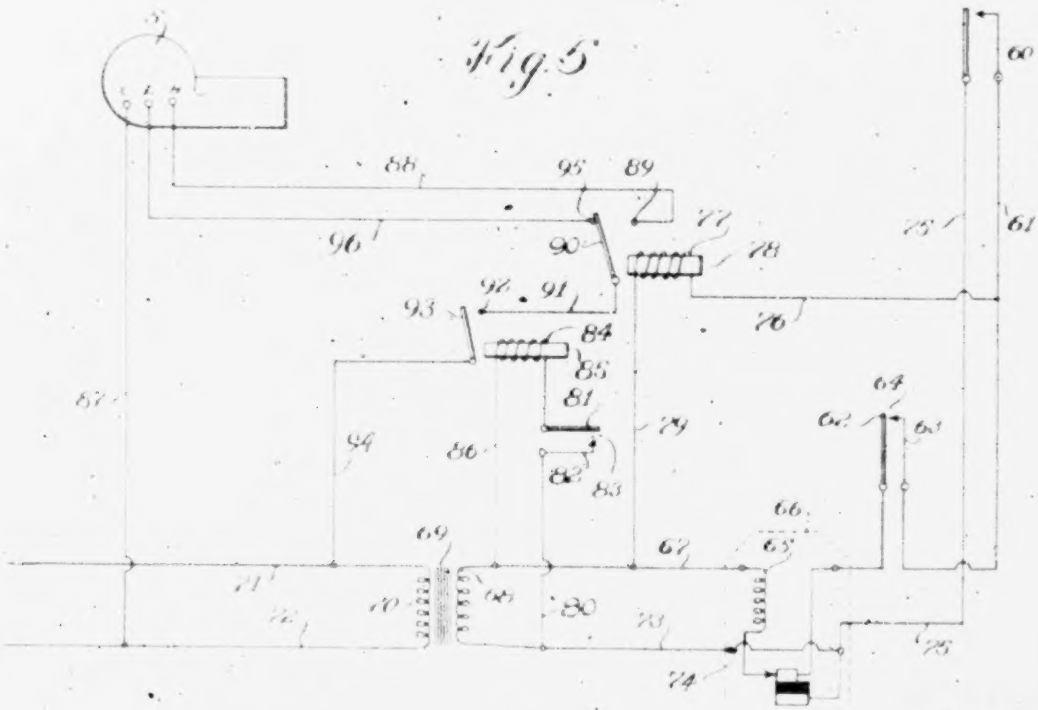
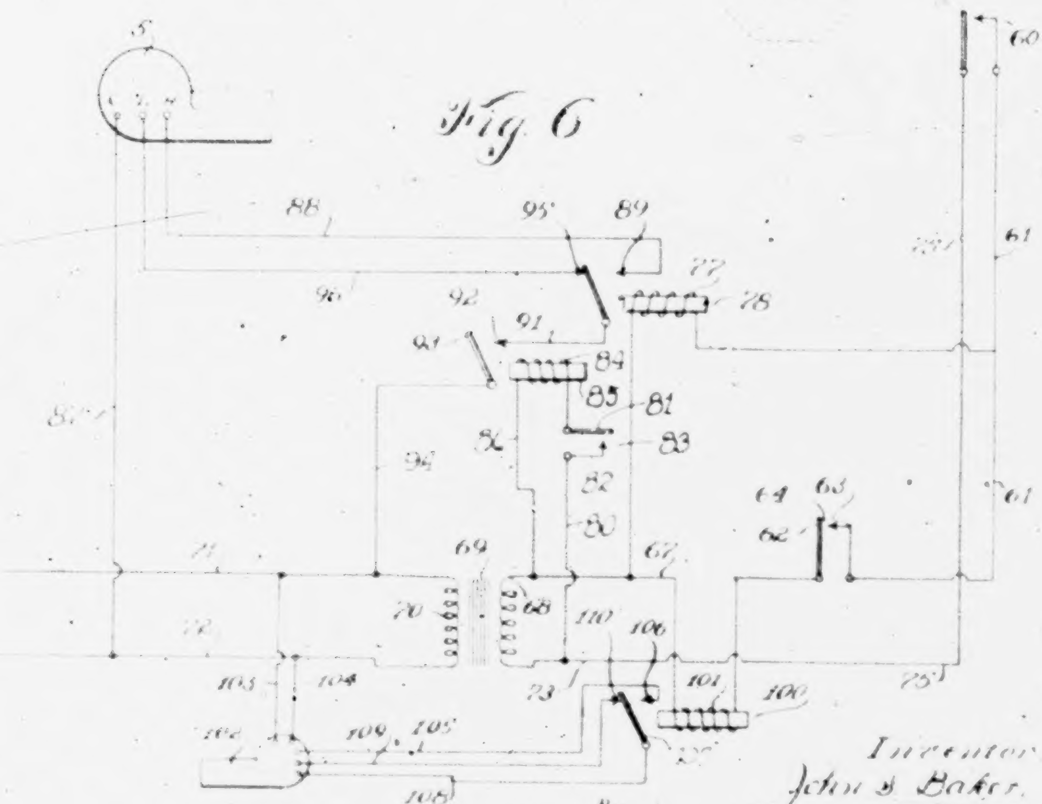


Fig. 6



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AUTOMATIC CONTROL SYSTEM FOR WARM AIR FURNACES

Filed July 16, 1934 4 Sheets-Sheet 4

Fig. 7

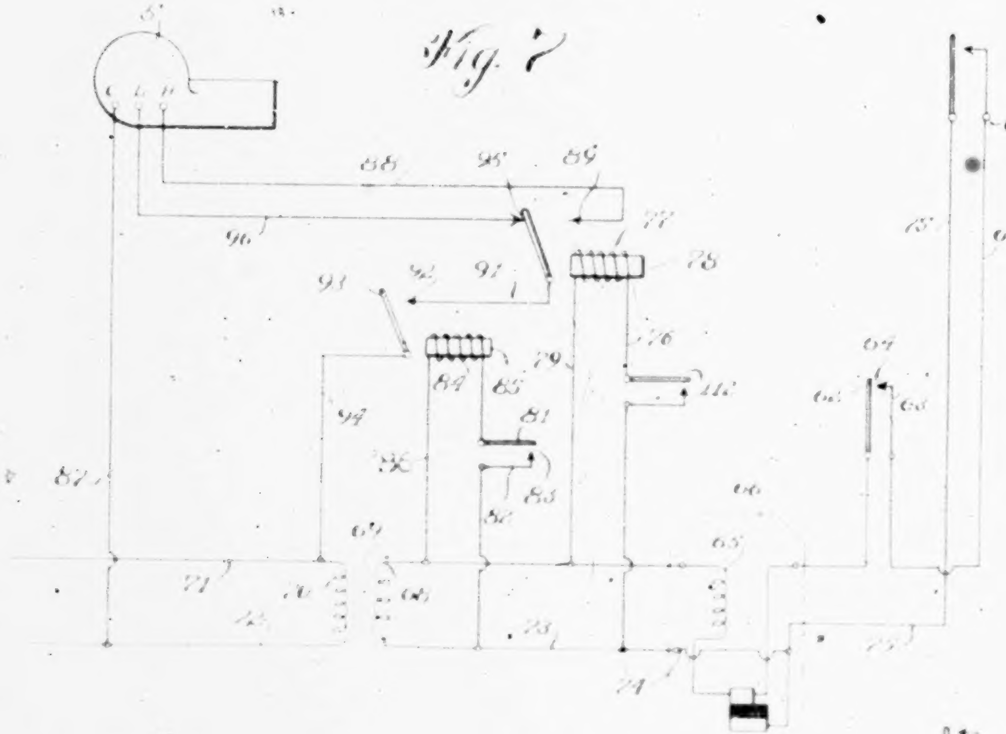
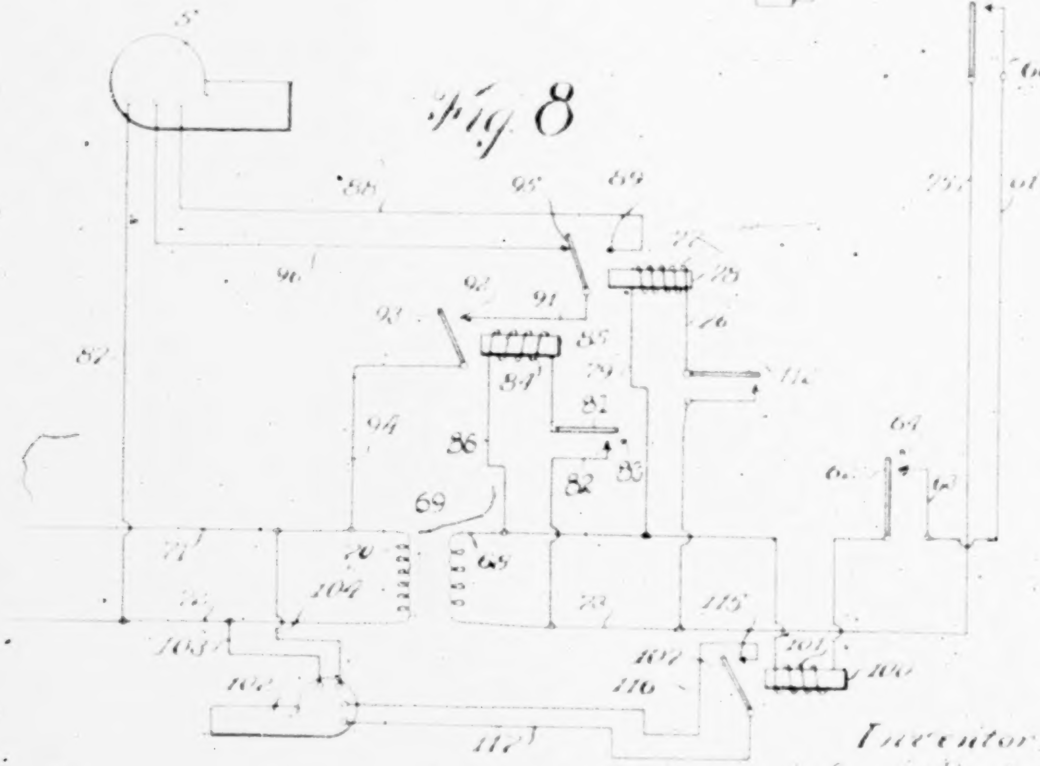


Fig. 8



Inventor,
John S. Baker
By Jones, Addington, Ames & Seibold
Attys.

UNITED STATES PATENT OFFICE

2,230,446

AUTOMATIC CONTROL SYSTEM FOR WARM AIR FURNACES

John S. Baker, Chicago, Ill., assignor to Cook Electric Company, Chicago, Ill., a corporation of Illinois

Application July 16, 1934, Serial No. 735,457

68 Claims. (Cl. 236—9)

This application is a continuation in part of my abandoned application 645,555 filed Dec. 3, 1932.

This invention relates to control apparatus principally for use with a warm air furnace.

More particularly, this invention relates to control apparatus adapted for use with warm air furnaces wherein forced drafts are utilized to support combustion and to bring heated air from the furnace into the room, the apparatus being preferably under the control of a thermostat in the room. It will be understood, however, that the invention is not limited to warm air furnaces utilizing forced drafts to support combustion and to supply heated air to the room, but may be used in ordinary heating systems employing equivalent instrumentalities of control for maintaining a relatively uniform room temperature.

In heating systems employing warm air furnaces, as heretofore provided, it has been customary to maintain the control of the furnace under the room thermostat and intermittently increase the rate of combustion as the room temperature drops and the thermostat calls for heat. It has been found, however, that intermittent operation of the heating system results in air stratification, with a temperature of 70° Fahr. (for example) in the region of the thermostat, which will satisfy the thermostat, and a lower temperature of several degrees at or directly above the floor. This condition is known as a "cold 70," is very undesirable and may be overcome chiefly by the use of a forced circulation. On the other hand, in view of poor conditions of chimneys and the uncertainties and variations of them, natural drafts have been found at times to be insufficient to secure proper combustion, particularly when outside conditions might tend to check a natural draft, although the room thermostat might be calling for heat and the outside temperature low enough to require a prompt response by the furnace to increase the combustion in order to prevent serious chilling of the room. Forced drafts for increasing combustion have been employed, however, but difficulty has been experienced in securing a heating system satisfactorily combining a forced circulation for bringing the heated air into the room to prevent stratification of the air and a "cold 70," and maintain a proper warm air circulation during the heating of the room with a forced draft for increasing the rate of combustion of the furnace sufficiently to prevent chilling of the room when the thermostat calls for heat.

An object of the invention, therefore, resides in an improved control apparatus adapted particularly for warm air heating systems in which a blower or the like may operate to furnish a forced draft, both to the furnace and warm air duct leading to the room or rooms to be heated, or to the warm air duct alone, either at high or low speeds, depending upon the temperature of the furnace bonnet at the time the room thermostat calls for heat.

A further object of the invention resides in providing improved control apparatus of this type capable of regulating the speed of operation of the blower, or other means furnishing the forced draft, whereby to obtain the proper forced draft and operation of the furnace and to maintain a relatively uniform room temperature at all times.

A further object of the invention resides in providing an electrical system wherein thermostatic means responsive to furnace temperature may control the operation of the blower or draft producing means, either to increase the rate of combustion or to increase the rate of delivery of heated air into the room.

A further object of the invention resides in providing an improved forced draft control of the type above described adapted for summer or winter use wherein the temperature of the room may be lowered and the air more effectively cooled in the summer months by keeping the air in constant circulation.

A still further object of the invention resides in control apparatus for warm air heating systems which includes humidity control means adapted to operate at such times as to supply proper amounts of moisture to the warm air and maintain the humidity of the room to be heated at a predetermined value, there being means to operate the humidity control means according to humidity conditions and temperature requirements of the room.

A still further object of the invention resides in control apparatus for warm air heating systems in which humidity control means may be employed to accomplish the results above mentioned, yet capable of use with a summer control arranged effectively to cool the room by keeping the air in circulation and to wash the air, if so desired, to maintain a relatively lower temperature, or a relatively uniform cool temperature.

Other objects and advantages of the invention

will be apparent from the following detailed description taken in connection with the accompanying drawings, in which:

Figure 1 is a view partly diagrammatic and partly structural of a two-wire circuit and apparatus embodying the invention;

Fig. 2 is a similar view illustrating a three-wire circuit permitting the use of a winter and summer control;

Fig. 3 is a detailed view of one form of humidity control particularly adapted for summer use;

Fig. 4 is a detailed view illustrating an oil or gas fired furnace connected in a system embodying the present invention;

Fig. 5 is a wiring diagram of a further embodiment of the invention;

Fig. 6 is a wiring diagram illustrating an oil or gas-fired furnace connected in this further embodiment of the invention;

Fig. 7 is a wiring diagram illustrating a still further embodiment of the invention; and

Fig. 8 is a wiring diagram illustrating an oil or gas-fired furnace used in the system shown in Fig. 7.

It may be mentioned at the outset that I contemplate employing a single blower so associated with control apparatus as to maintain a constant circulation of air at low speed through the warm air duct of the furnace and to the rooms until the room thermostat calls for heat. When the room thermostat calls for heat, the control apparatus acts to divert a portion of the blower discharge into the fire box of the furnace to act as a forced draft and to allow the remaining air from the blower to continue circulating through the duct and into the room, which tends, of course, to lower the normal circulation and produce a sensible feeling of a rising temperature. When the forced draft increases the combustion and raises the furnace temperature, the control apparatus acts to increase the speed of the blower to increase the velocity of its discharge as well as to discontinue the forced draft to the furnace. All the air circulated by the blower at high speed will pass through the warm air duct into the room until the room thermostat has been satisfied and its circuit opened. By arranging the control apparatus to keep the blower continuously operating, there will be a constant flow of air through the bonnet of the furnace, which will prevent any overheating and serious damage of the furnace, or which, in summer, will maintain the room at a comfortably cool temperature.

There is preferably included in the control apparatus a relay operating under the control of a furnace thermostat for determining the speed of operation of the blower. The control apparatus may further include a humidostat adapted to operate preferably when the blower is operating at high speed to control the humidity of the air supplied to the blower and to the room through the furnace air duct according to the humidity requirements of the air already in the room. In the event it is desirable to utilize the heating system as a ventilating and cooling system during the summer months, a summer and winter control may be incorporated and the room thermostat employed to control the apparatus according to room temperature. The relay may be operated by the room thermostat when a predetermined high room temperature is reached to run the blower at high and low speed and to place a humidity control in operating condition not only to control the humidity of the air supplied to the room but also to cool the air by washing it if so desired.

Referring to Fig. 1, it will be understood that the furnace may be of any type other than that of the warm air type, and there may be used coal or other solid fuel, or liquid fuel, such as oil or gas, suitable arrangements being made in connection with the control apparatus to allow for such well known variations in the heating art.

Furnace 1 includes a fire box 2, a warm air duct 4, forming a bonnet for the furnace, and one or more warm air ducts 3 leading to the room or rooms to be heated. A blower 5 is illustrated as communicating with warm air duct 4 by a passage 6 and with the fire box 2 by a passage 7.

An electrically operated damper controller 8 is arranged to actuate a damper 9 adapted to swing to open and closed positions at or adjacent to the outlet of blower 5.

Damper 9 may be pivotally mounted to close passage 7 leading to fire box 2 of furnace 1 when swung to closed position and to open passage 7 when swung to its open position, as shown in dotted lines in Fig. 1. It will be understood that the exact location or movement of damper 9 to accomplish the results herein disclosed need not be limited as shown in the drawing, because it will be obvious to those skilled in the art that various other damper constructions may be provided without departing from the essence of the present invention.

Electrically operated controller 8 may include any suitable motor, but as shown, may be a vapor motor having a heating element 10 and a coil 11 arranged in a circuit including wires 12 and 13. It is not believed necessary to describe in detail the construction of the vapor motor because any suitable type of motor may be used. It is only essential to employ a prime mover capable of operating damper 9 to open passage 7 when it is desired to provide a forced draft to the fire box to increase the rate of combustion and to close this passage when the heat of the furnace rises above a predetermined tmperature.

The motor circuit, including wires 12 and 13, may include a secondary coil 14 of a transformer 15 having its primary coil 16 connected across the line wires 17 and 18. The circuit of room thermostat 20 includes a wire 21 connecting to secondary coil 14 of transformer 15 and a wire 22 connecting to an intermediate contact 23 of a furnace thermostat 24. Furnace thermostat 24 may be, if so desired, of a type including a cold contact 25 and a hot contact 26. Cold contact may connect to motor circuit wire 12 by a wire 27. Hot contact 26 may include in its connections a control element, such as a relay 28 connected in the line by a wire 29 and to this hot contact 26 by a wire 30. Furnace thermostat may be known as a limit switch adapted to close the motor circuit of the electrically operated damper controller 8 when room thermostat 20 calls for heat and the furnace is at a predetermined low temperature. This limit switch may also act to energize relay 28 while room thermostat 20 is still calling for heat, although the heat of the furnace has been increased to a predetermined temperature.

As previously stated, it is desirable to operate blower 5 at low and high speeds, the low speed effecting a circulation of air which is just sufficient to keep the air in the room in circulation

to prevent air stratification, and, when the thermostat calls for heat and the furnace is cold, to supply a forced draft sufficient to increase the furnace temperature, and also to allow a portion of this circulation to continue to the room, the decreased air flowing to the room as the result of a portion being used as a forced draft, causing a sensible feeling of a rising temperature at a time when the room is cold and awaiting heat from the furnace. The low speed circuit includes a wire 34, armature 33, wire 32, blower 5 and return wire 35. The high speed circuit includes wire 34, armature 33, wire 36, blower 5 and return wire 35.

It is possible to include a humidifying control for controlling the humidity of the air taken in by the blower at its inlet in accordance with the humidity conditions of the air in the room. It is desirable, however, to operate the humidifying control preferably when the blower is operating at high speed and supplying its air discharge to the warm air conduit 4 of the furnace and to the room. This humidifying control may include a transformer 38 connected across the high speed circuit of blower 5. Transformer 38 includes a primary coil 39 and a secondary coil 40, primary coil 39 being connected by the wires 41 and 42 with the wires 36 and 35, respectively, of the high speed blower circuit. Secondary coil 40 may include a humidostat 43 and a humidifying device 44.

The three-wire circuit shown in Fig. 2 includes a summer and winter control also permitting the use of the heating system as an air ventilating and cooling system during the summer months.

It will be noted that a winter switch 45 is inserted in the wire 22 leading from room thermostat 20 to the middle contact 23 of furnace thermostat 24. In the summer months, switch 45 is opened, while a summer switch 46 in a wire 47 leading from a hot contact 48 of room thermostat 20 to wire 30 is closed. It will be observed, therefore, that a heating system embodying my invention may be converted in a simple fashion to a ventilating and cooling system in the summer months by the mere provision of a room thermostat having hot and cold contacts and a summer and winter switch including the connection 47 leading to wire 30 controlling relay 28. A hot room temperature will cause room thermostat 20 to close the circuit at hot contact 48 and energize relay 28 to close the high speed blower circuit. Blower 5 will operate at high speed to supply the required air to maintain a comfortable ventilation in the room.

On the other hand, the humidifying apparatus disclosed in Fig. 1 may be converted into a cooling apparatus as shown in Fig. 3 by providing the humidifying device 44 in the form of a sprayer or air washer 50 arranged in a suitable tank 51 having any suitable air inlet and a duct 53 leading from the intake of blower 5. If it is not desirable to wash the air as shown in Fig. 3, the humidifying device 44 may act to merely provide sufficient humidity to the air supplied to the intake of the blower according to the humidity conditions of the air in the room. It is desirable to include a snap switch 57 in the low speed circuit of the blower so as to permit cutting out of the low speed circuit of the blower during the summer months, however, it will be apparent that failure to open switch 57 during the summer months will permit the blower to operate continuously at low speed, thereby supplying a continuous circulation of the cooling medium to the room during the summer period, except when the temperature of the room rises to close the hot contact of the room thermostat and operate the blower at high speed to effect a more rapid cooling action.

Inasmuch as the control apparatus is entirely automatic and may operate, therefore, as aforesaid, throughout the year without requiring attention other than to operate the winter and summer switches 45 and 46, it may be desirable to provide a snap switch 58 in the line circuit above transformer 15 in order to disable the automatic operation at any time.

The operation of the control apparatus above described will now be given: Assume that the winter switch 45 is closed and the summer switch 46 is open and the temperature of the room has dropped sufficiently to close the cold side of room thermostat 20. If the furnace is cold, the motor circuit of the electrically operated damper controller 8 is closed at the furnace thermostat 24. The electrically operated damper controller 8 swings the damper 9 to open position. It will be understood, however, that during this period the blower 5 is operating at low speed, relay 28 has not been energized and armature 33 is in a position bridging the contact of wire 32 of the low speed blower circuit. After damper 9 is swung to open position, a portion of the blower discharge is fed through passage 7 to the fire box to act as a forced draft and to increase the rate of combustion. The remaining portion of the blower discharge passing to duct 4 and the room through duct 3 is less than is normally fed to the room at low speed of the blower, with the effect that there is a sensible feeling of a rising room temperature at a time when the room is cold and about to receive heat from the furnace.

When the heat of the furnace reaches a predetermined temperature, furnace thermostat 24 closes the circuit across its hot contact and operates the control element 28, such as the relay, to swing armature 33 from its contact with wire 32 to the contact of the high speed blower wire 36. Thereupon blower 5 will operate at high speed to increase the blower discharge, and consequently, the circulation of air to the room. When movable contact 23 of furnace thermostat 24 swings from cold contact 25 to hot contact 26, to energize relay 28, the motor circuit of damper controller 8 will open. The cooling effects of the air discharge of bolwer 5 will tend to accelerate the return movement of the electrically operated damper controller 8 if the prime mover of this controller is a heat motor with its heating unit 10 arranged in the path of the air flow from the blower, as shown in Fig. 1. The forced draft to the furnace is discontinued, therefore, when the blower operates at high speed. By increasing the blower discharge upon a predetermined rise of temperature, rapid and satisfactory heating of the room is assured without the danger of this increased air circulation being sent to the room cold. Also, increasing the air circulation when the furnace is hot prevents any tendency of the furnace to overheat.

If the room thermostat 20 is still calling for heat and the furnace temperature has been lowered by the increased circulation of air from blower 5, furnace thermostat 24 causes its movable contact 23 again to engage cold contact 25 and operate the damper controller 8 so as to swing damper 9 to open position. At the same time the circuit is broken, of course, at the hot contact 26 of the furnace thermostat 24, with the result that

armature 33 drops back to its low speed position connecting wires 32 and 34. Blower 5 immediately operates at low speed and supplies air, a portion of which is again utilized as a forced draft for the fire to increase its rate of combustion. When furnace temperature is again raised, the movable contact 23 will bridge hot contact 26 of furnace thermostat 24. The damper 9 is again closed and the blower is operated at high speed to increase the circulation of air at its discharge outlet. This increased circulation of air again enters the warm air conduit 4 to be heated and fed to the room or rooms through warm air duct or ducts 3. This cycle of operation is repeated until the room thermostat 20 is satisfied.

It will be noted that the humidifying apparatus operates to increase the humidity of the air supplied to the intake of blower 5, preferably when this blower is operating at high speed and supplying its discharge to the room.

If it is desirable to utilize the heating system herein disclosed as a ventilating and cooling system during the summer months, the winter switch 45 is opened and the summer switch 46 is closed. Control element or relay 28 is placed under the direct control of room thermostat 20, instead of furnace thermostat 24, and is actuated when room thermostat closes the circuit at hot contact 48 upon a predetermined rise of room temperature. Blower 5 will then operate at high speed to supply sufficient circulation of air to provide adequate ventilation to the room. If it is desirable to wash the air for the purpose of cooling it, the humidifying device 44 may be a sprayer 50, as shown in Fig. 3, arranged to wash the air entering tank 51 and the pipe 59 leading to the intake of blower 5. Switch 57 may be opened during the summer months to prevent the blower from operating at low speed when the room thermostat is not closed at its hot contact 48, and switch 58 may be opened at any time to cut out the operation of the humidity control circuit.

As before stated, furnace 1 may be of any suitable type and fired by coal or other solid fuel, or liquid fuel, such as oil or gas. In Fig. 4, I have illustrated diagrammatically an electrically operated control 60', such as an oil valve or gas valve, connected in parallel across the wires 12 and 13 of the motor circuit of the damper controller 8, which will operate to supply fuel, in varying amounts as may be necessary to control the rate of combustion, when thermostat 20 calls for heat and damper controller 8 operates to allow a portion of the air circulation to enter the fire box as a forced draft. Control 60' is merely illustrative of one way in which the present apparatus may be adapted to different furnaces or heating systems.

It is not essential to control the rate of combustion where it is desirable to use the high and low speed blower to control circulation of hot air only from the furnace 1, or the heat-conducting medium, such as hot water, steam or the like, in case of furnaces other than the warm air type. Accordingly, in Fig. 5 there is illustrated the heating system omitting the apparatus and connections providing a forced draft through passage 7 to fire-box 2. The circuit of room thermostat 60 will include wire 61, contacts 62 and 63 of a furnace switch 64, coil 65 of a draft controller 66, wire 67, a secondary coil 68 of a transformer 69, a wire 73, a connection 74 through damper controller 66, and a wire 75.

Two relay circuits are preferably connected across the opposite sides of the circuit of the room thermostat 60. The first relay circuit includes a wire 76, the coil 77 of a relay 78, and a wire 79. The second relay circuit includes a wire 80, the contacts 81 and 82 of a furnace switch 83, the winding 84 of a relay 85, and a wire 86.

The high speed circuit of blower 5 may include a wire 87, blower 5, a wire 88, a contact 89, an armature 90 of relay 78, a wire 91, a contact 92, an armature 93 of relay 85, and a wire 94.

Draft controller 66 is so arranged that, when its actuating coil 65 is energized, it opens the draft and closes the check, and, when deenergized, it closes the draft and opens the check.

Furnace switch 64 is preferably disposed in the room thermostatic circuit between the damper controller 66 and the room thermostat 60. The movable contact 63 of this furnace switch 64 is adapted to disengage contact 62 and open the room thermostatic circuit when the temperature of the furnace rises above or exceeds a predetermined degree. Accordingly, furnace switch 64 prevents overheating of the furnace by opening the circuit to deenergize actuating coil 65 of the damper controller 66, although room thermostat 60 may continue to call for heat. However, if the temperature of the furnace does not exceed a predetermined degree, the circuit of the room thermostat will remain closed to accelerate combustion at the furnace as long as the room thermostat 60 calls for heat.

The relay circuit, including relay 78, is energized when the current flows through the circuit of the room thermostat. Relay 78 actuates armature 90 to close the high speed circuit of blower 5 at contact 89. However, current will not flow through the high speed circuit of blower 5 if the temperature of the furnace drops below a predetermined degree. This is accomplished by an auxiliary circuit embodying relay 85. The furnace switch 83 is arranged to open this auxiliary circuit in the event the temperature of the furnace falls below a predetermined degree, say, for example, below 100° Fahr. Consequently, it will be impossible for blower 5 to deliver air at a temperature not high enough to raise the temperature in the room. It is found that where the temperature of the furnace is too low, operation of the blower will deliver cold air into the room.

If the furnace is above this predetermined low point, contact 82 of furnace switch 83 will engage contact 81 to energize the relay 85, and cause this relay to attract armature 93 into circuit closing position against contact 92. Current will then flow from one side of the line, wire 94, armature 93, contact 92, wire 91, armature 90 of relay 78, contact 89, wire 88, blower 5, and through wire 87 to the other side of the line.

It will be observed that this arrangement of the apparatus will effect high speed operation of blower 5 whenever room thermostat 60 calls for heat and the furnace is below a predetermined high temperature, say, for example, 165° Fahr., but above a predetermined low temperature, say 100° Fahr. If the room thermostat 60 is satisfied and there is no demand for heat in the room, or if the furnace temperature is above said predetermined high degree of 165° Fahr., such as might cause overheating of the furnace, the actuating coil 65 of damper controller 6 will be deenergized and the combustion checked by the draft opening and the check closing. Moreover, if the room thermostat 60 opens, relay 78 will be

1699 Northern District of Illinois } ss:
Eastern Division }

I, Hoyt King, Clerk of the District Court of the United States for the Northern District of Illinois, do hereby certify the above and foregoing to be a true and complete transcript of the proceedings had of record made in accordance with Designation, Additional Designation and Amended Designation filed in this Court in the cause entitled The Mercoid Corporation vs. Minneapolis-Honeywell Regulator Company, Consolidated Cause No. 1839, as the same appear from the original records and files thereof now remaining in my custody and control.

In Testimony Whereof, I have hereunto set my hand and affixed the seal of said Court at my office, in the City of Chicago, in said District, this 22nd day of May, A. D. 1942.

Hoyt King,
Clerk.

(Seal)

United States Circuit Court of Appeals

For the Seventh Circuit.

I, Kenneth J. Carrick, Clerk of the United States Circuit Court of Appeals for the Seventh Circuit, do hereby certify that the foregoing printed pages contain a true copy of Volume two of the printed record, which together with Volume one, constitutes the record, in Causes Nos.:

The Mercoid Corporation,
Plaintiff-Appellee,
8019 *vs.*
Minneapolis-Honeywell Regulator Company,
Defendant-Appellant.

The Mercoid Corporation,
Plaintiff-Appellant,
8020 *vs.*
Minneapolis-Honeywell Regulator Company,
Defendant-Appellee,

as the same remains upon the files and records of the United States Circuit Court of Appeals for the Seventh Circuit.

In Testimony Whereof I hereunto subscribe my name and affix the seal of said United States Circuit Court of Appeals for the Seventh Circuit, at the City of Chicago, this 23rd day of April, A. D. 1943.

Kenneth J. Carrick,
(Seal) *Clerk of the United States Circuit Court of Appeals for the Seventh Circuit.*

At a regular term of the United States Circuit Court of Appeals for the Seventh Circuit held in the City of Chicago and begun on the sixth day of October, in the year of our Lord one thousand nine hundred and forty-two, and of our Independence the one hundred and sixty-seventh.

The Mercoid Corporation, *Plaintiff-Appellee*, 8019 *vs.* Minneapolis-Honeywell Regulator Company, *Defendant-Appellant.*	Appeals from the District Court of the United States for the Northern District of Illinois, Eastern Division.
The Mercoid Corporation, *Plaintiff-Appellant*, 8020 *vs.* Minneapolis-Honeywell Regulator Company, *Defendant-Appellee.*	

And, to-wit: On the twenty-third day of May, 1942, there was filed in the office of the Clerk of this Court, in cause No. 8019, an appearance of counsel for appellant, which said appearance is in the words and figures following, to-wit:

IN THE UNITED STATES CIRCUIT COURT OF APPEALS

For the Seventh Circuit.

The Mercoid Corporation, *Plaintiff*, vs. Minneapolis-Honeywell Regulator Company, *Defendant*.	Appeal No. 8019.

ENTRY OF APPEARANCE.

Please enter our appearance as counsel for Minneapolis-Honeywell Regulator Company in the above identified cause.

Bair & Freeman,
Room 1400—135 South LaSalle Street,
Chicago, Illinois.

Of Counsel:
W. P. Bair,
Will Freeman.
(Chicago, Illinois, May 23, 1942.)

Endorsed: Filed May 23, 1942. Kenneth J. Carrick, Clerk.

And on the same day, to wit: On the twenty third day of May, 1942, there was filed in the office of the Clerk of this Court, in cause No. 8020, an appearance of counsel for appellant, which said appearance is in the words and figures following, to wit:

United States Circuit Court of Appeals

For the Seventh Circuit.

Cause No. 8020.

The Mercoid Corporation,

vs.

Minneapolis-Honeywell Regulator Company.

The Clerk will enter our appearance as counsel for The Mercoid Corporation.

Langdon Moore,
Langdon Moore,
L. Kerans Moore,
L. Kerans Moore,
53 W. Jackson Boulevard,
Chicago.

Endorsed: Filed May 23, 1942. Kenneth J. Carrick, Clerk.

And afterwards, to-wit: On the fifth day of November, 1942, the following further proceedings were had and entered of record, to-wit:

Thursday, November 5, 1942.

Court met pursuant to adjournment.

Before:

Hon. William M. Sparks, Circuit Judge.
Hon. J. Earl Major, Circuit Judge.
Hon. Sherman Minton, Circuit Judge.

The Mercoid Corporation,
Plaintiff-Appellee,
8019 *vs.*
Minneapolis-Honeywell Regulator Co.,
Defendant-Appellant.

The Mercoid Corporation,
Plaintiff-Appellant,
8020 *vs.*
Minneapolis-Honeywell Regulator Co.,
Defendant-Appellee.

Appeals from the District Court of the United States for the Northern District of Illinois, Eastern Division.

Now this day come the parties by their counsel, and this cause comes on to be heard on the transcript of the record and briefs of counsel, and on oral argument by Mr. Langdon Moore, counsel for The Mercoid Corporation, and by Mr. Will Freeman and Mr. W. P. Bair, counsel for Minneapolis-Honeywell Regulator Co., and the Court takes this matter under advisement.

And afterwards, to-wit: On the twenty-third day of December, 1942, there was filed in the office of the Clerk of this Court, the Opinion of the Court, which said Opinion is in the words and figures following, to wit:

IN THE UNITED STATES CIRCUIT COURT OF APPEALS

For the Seventh Circuit.

October Term and Session, 1942.

No. 8019.
THE MERCOID CORPORATION,
Plaintiff-Appellee,
vs.
MINNEAPOLIS-HONEYWELL REGULATOR COMPANY,
Defendant-Appellant.

No. 8020.
THE MERCOID CORPORATION,
Plaintiff-Appellant,
vs.
MINNEAPOLIS-HONEYWELL REGULATOR COMPANY,
Defendant-Appellee.

Appeals from the District Court of the United States for the Northern District of Illinois, Eastern Division.

December 23, 1942.

Before SPARKS, MAJOR and MINTON, *Circuit Judges.*

SPARKS, *Circuit Judge.* In cause No. 8019, the Mercoid Corporation (hereafter referred to as Mercoid) asked for a declaratory judgment holding United States Patent No. 1,813,732 to Freeman, owned by Minneapolis-Honeywell Regulator Company (hereafter referred to as Honeywell) void and not infringed, and that that patent was being used to extend the patent monopoly beyond the bounds of its claims in violation of the Anti-Trust laws. In cause No. 8020, Honeywell, before it was notified of Mercoid's suit, charged Mercoid with infringement of claims 1, 4, 6 and 9 of the Freeman patent, by its sale of Mercoid's Combina-

tion Fan Limit Control with wiring diagrams showing how to install it. The patent was issued on July 7, 1931, upon an application filed January 16, 1931, and assigned to Honeywell.

Honeywell, answering Mercoid's complaint, averred validity and infringement by Mercoid, and denied any alleged improper use of its patent. Mercoid, in answering Honeywell's complaint, denied validity and infringement, alleged the same improper use of the patent, and counterclaimed for damages for violation of the Anti-Trust laws.

The cases were consolidated for trial before the District Court, which held the patent valid and infringed, and that Honeywell was not guilty of laches, but further held that Honeywell could not maintain a suit for infringement because it had used the patent to control the sales of articles beyond its scope. The court disallowed damages against Honeywell for violation of the Anti-Trust laws and dismissed both complaints. From this decree both parties have appealed.

Freeman's combination relates to control apparatus for use with a hot air furnace. Its principal object is to provide a control for the rate of combustion and for the operation of an accelerating device, such as a fan, blower or similar apparatus, used for accelerating the rate of supply of the heat-conducting medium, such as air, to be heated by a furnace, said control being such as to permit the operation of the accelerating device and to check combustion in case the furnace becomes overheated, and such as to interrupt the operation of such accelerating device while increasing the rate of combustion if the furnace has not been heated above a predetermined temperature. In addition, a control feature is added by means of which both the combustion and the supply of the heat-conducting medium are checked when the temperature of the room or object to be heated is above a predetermined degree.

Mercoid's device, which was held to infringe the patent, is referred to by the parties as M-80. The District Court wrote an opinion in these cases (*Mercoid Corporation v. Minneapolis-Honeywell Regulator Co.*, 43 Fed. Supp. 878) in which it set forth the patent claims in issue and discussed the issues including prior art, prior uses and laches.

and they will not be repeated here. It is sufficient to say that the finding could not well have been otherwise under the evidence presented, and we approve that court's reasoning and conclusions with respect to validity, infringement and laches. This brings us to what we regard as the vital questions in this case,—whether Honeywell has so misused the Freeman system of furnace control as to bar its suit for infringement, and whether its misuse, if any, constitutes a violation of the Anti-Trust laws. Both the answer in bar and the charge of violation of the Anti-Trust laws are based upon the same allegations of misuser.

The District Court based its decision as to Honeywell's misuse upon the rule referred to in *Morton Salt Co.* v. *Suppiger Co.*, 314 U. S. 488. That rule, which is equitable in its nature and of general application, asserts that courts, and especially courts of equity, may appropriately withhold their aid where the plaintiff is using the right asserted contrary to the public interest. The Morton case involved a patented mechanism for depositing salt tablets, a device said to be useful in the canning industry for adding predetermined amounts of salt in tablet form to the contents of the cans. The patent was on the mechanism, not on the salt nor on its configuration. Salt is an article of commerce, quite generally used from time immemorial. It is unpatented and is not an element of the patent upon which Morton relied. However, Morton sought to compel the purchasers of its patented mechanism to use only the salt purchased from it, which was in no sense a part of the patent. The Supreme Court held that Morton could not do this because to do so would constitute a contributing factor in thwarting the public policy underlying the grant of the patent. The Court stated quite generally that a patent could not be used as a means of restraining competition with the patentee's sale of an unpatended *product*. It is to be noted that the Court carefully refrained from using the word *element* instead of the word *product*, because in that case salt was not an element of that patent, nor did that patent cover a product. The salt tablets in no sense could be considered as the "advance in the art" in the patent there in suit.

The patent here covers a furnace control system having a combustion control apparatus, a fan to force hot air from

the furnace to the rooms, a thermostatic apparatus for controlling the combustion control apparatus and fan. It discloses a hand fired furnace with dampers and also a furnace with a stoker.

With respect to the stoker-operated furnace, a room thermostat normally starts the stoker. There is also a thermostat which breaks the stoker circuit when the air in the furnace reaches a predetermined high temperature, even though the room thermostat is calling for heat. This is for the purpose of preventing unsafe overheated conditions. Another thermostat is also placed in the furnace which does not permit the fan to start until the air in the furnace reaches a certain heat. It then starts the fan which continues to run so long as the furnace is hot and the room thermostat calls for heat, even if the stoker is stopped by the limit switch.

Honeywell urges that Freeman's advance in the art is the arrangement of thermostat switches, subject to furnace heat, in connection with other parts, to secure a sequence of operations whereby combustion is stopped before excessive heat is reached in the furnace, but the fan continues to run and take the heated air from the furnace and deliver it to the rooms. The claims, it will be noticed, include the necessary combustion control and fan, and, in some cases, the room thermostat, together with the thermostatic fan and limit switch connected to secure sequence of operations.

Mercoid's M-80 is a combination fan and limit control. It has two thermostatically operated switches in a single casing so arranged as to permit the fan to operate when the limit switch has opened the circuit of the stoker motor for stopping combustion when a dangerous and excessive temperature has arisen in the furnace. It provides for the sequence of operations which is the precise essence of Freeman's advance in the art. With each M-80, Mercoid provides certain wiring diagrams for installation. The accused device has no other use than for accomplishing the sequence of operations of the Freeman patent. Mercoid's expert testified that when installed according to Mercoid's diagram it infringed the Freeman patent. The District Court was warranted in relying on this evidence and we are convinced that it is true.

Honeywell has granted licenses to others and offered a license to Mercoid on the same terms and conditions, which was refused. Mercoid contends that these licenses involve use of the patent to monopolize the sale and control of devices not covered by the patent and this, it urges, bars Honeywell's right to maintain an infringement suit and also violates the Anti-Trust laws. These licenses call for payment of a royalty on the defined combination furnace control which embodies the essence of Freeman's patent. Each of such controls brings about one complete Freeman installation, and the record does not disclose any attempt on the part of Honeywell to collect a royalty on such control unless it is used or attempted to be used in a system which would infringe the Freeman combination. In this we think there is no attempt to illegally monopolize the sale of the Honeywell control unless it is used or intended to be used in the Honeywell system.

All licenses issued by Honeywell are the same in so far as the issues before us are concerned. Section 1 of the license here involved is as follows: "As used in this agreement, the expression 'Combination Furnace Control' shall mean a unitary structure including at least a switching means for controlling not less than two circuits and operated by temperature responsive means responsive to the temperature of a heating device or the fluid medium heated thereby, one of said circuits being established on temperature rise and another being established on temperature fall, the structure having permanent internal wiring connecting the switching means to terminals for the connection of external wires thereto, the internal wiring being so arranged that when the terminals are connected by external wires to a heat controlling mechanism or a combustion controlling mechanism for the heating device and to a means for controlling the circulation of the fluid medium heated thereby, such structure, when used as intended, embodies the system disclosed in and claimed by the Freeman patent * * *. It being understood that this definition is not intended so far as said Freeman Patent is involved to limit the combinations in or with which said 'Combinaton Furnace Control' may be used by Licensee or its vendees."

Mercoid contends that these licenses involve use of the

patent to monopolize the sale of the control which of itself is not covered by the patent, and this it urges bars Honeywell's right to maintain an infringement suit, and also violates the Anti-Trust laws. In other words, it argues that Honeywell is guilty of inequitable conduct and of violating the Anti-Trust laws because it does not sell Freeman's systems, but sells unpatented controls which are not within the scope of the Freeman patent. This record discloses that the only Honeywell control which gets protection as a result of the licenses is the control usable only for a Freeman type installation, which of course embodies the Freeman "advance in the art." It further discloses that Honeywell never accused anyone under the Freeman patent on account of the sale of standard controls, which might be used with the Freeman installation, or might be used with some other installation. So far as we have been able to discover from this record, all the conduct of Honeywell which is here complained of has been solely directed toward the protection of the Freeman patent. The patent laws permit such conduct and the Anti-Trust laws do not forbid it. *Bement* v. *National Co.*, 186 U. S. 70; *United States* v. *United Shoe Machinery Co.*, 247 U. S. 32; *United Shoe Machinery Co.* v. *U. S.*, 258 U. S. 451.

It has long been held that the owner of a patent may restrain contributory infringement, if within his rights under the patent law, providing his conduct is otherwise proper. *Wallace* v. *Holmes*, 29 Fed. Cases, No. 17,100, 9 Blatchf. 65. It has been held further that one is an infringer if he makes and sells an unpatented element of a combination which serves to distinguish the invention, that is to say, to make the advance upon the prior art, knowing that it is to go into the patented combination. *Leeds & Catlin* v. *Victor Co.*, 213 U. S. 325.

In support of its contention to the contrary, Mercoid relies upon *Carbice Corp.* v. *American Patents Corp.*, 283 U. S. 27, and *Leitch* v. *Barber*, 302 U. S. 458, and kindred cases. In the Carbice case, the Supreme Court said that it was wholly unlike the Leeds & Catlin case, and in the Leitch case, the Court said that there was nothing in the Leeds & Catlin case that limited the rule in the Carbice case. Other cases upon which Mercoid relies are *Motion Picture Patents Co.* v. *Universal Film Co.*, 243 U. S. 502;

Morton Salt Co. v. Suppiger Co., supra; B. B. Chemical Co. v. Ellis, 314 U. S. 495; *American Lecithin Co. v. Warfield Co.*, 105 F. 2d 207; and *Philad Co. v. Lechler Laboratories*, 107 F. 2d 747. In all these cases the objectionable conduct was directed toward the sale of something which was not the advance in the art and did not necessarily measure or mark the use covered by the patent.

We find no evidence in this case that Honeywell by its conduct or by its license required anyone to buy any element or elements of the patent from Honeywell or its licensees, but all of its conduct complained of was directed to the protection of Freeman's advance in the art. This we think was well within its rights and we find no decision to the contrary. Since it has not exceeded any of its rights under the patent, on the same facts it cannot be said that it has violated the Anti-Trust laws.

The decree of the District Court is affirmed in all respects, except as to its decree that Honeywell has been so using its Freeman patent as to tend to create a monopoly in an unpatented device, and in dismissing Honeywell's complaint, and in the assessment of costs. In these respects the decree is reversed and the cause is remanded to the District Court for further proceedings not inconsistent with this opinion.

Endorsed: Filed December 23, 1942. Kenneth J. Carrick, Clerk.

And on the same day, to-wit: On the twenty-third day of December, 1942, the following further proceedings were had and entered of record, to-wit:

Wednesday, December 23, 1942.

Court met pursuant to adjournment.

Before:

Hon. William M. Sparks, Circuit Judge.
Hon. J. Earl Major, Circuit Judge.
Hon. Sherman Minton, Circuit Judge.

The Mercoid Corporation, *Plaintiff-Appellee*, 8019 *vs.* Minneapolis-Honeywell Regulator Co., *Defendant-Appellant.*	Appeal from the District Court of the United States for the Northern District of Illinois, Eastern Division.

This cause came on to be heard on the transcript of the record from the District Court of the United States for the Northern District of Illinois, Eastern Division, and was argued by counsel.

On Consideration Whereof: It is ordered, adjudged and decreed by this Court that the decree of the said District Court in this cause appealed from be, and the same is hereby, affirmed, with costs, except as to its decree that Honeywell has been so using its Freeman patent as to tend to create a monopoly in an unpatented device, and in dismissing Honeywell's complaint and in the assessment of costs, and in these respects the decree is reversed, and this cause be, and the same is hereby, remanded to the said District Court for further proceedings not inconsistent with the Opinion of this Court filed this day.

The Mercoid Corporation, *Plaintiff-Appellant*, 8020 *vs.* Minneapolis-Honeywell Regulator Co., *Defendant-Appellee.*	Appeals from the District Court of the United States for the Northern District of Illinois, Eastern Division.

This cause came on to be heard on the transcript of the record from the District Court of the United States for the

Northern District of Illinois, Eastern Division, and was argued by counsel.

On Consideration Whereof: It is ordered, adjudged and decreed by this Court that the decree of the said District Court in this cause appealed from be, and the same is hereby, affirmed, with costs, except as to its decree that Honeywell has been using its Freeman patent as to tend to create a monopoly in an unpatented device, and in dismissing Honeywell's complaint and in the assessment of costs, and in these respects the decree is reversed, and this cause be, and the same is hereby remanded to the said District Court for further proceedings not inconsistent with the Opinion of this Court filed this day.

And afterwards, to-wit: On the twenty-ninth day of December, 1942, there was filed in the office of the Clerk of this Court, a Stipulation extending time to file Rehearing, which said Stipulation is in the words and figures following, to-wit:

IN THE UNITED STATES CIRCUIT COURT OF APPEALS

For the Seventh Circuit.

The Mercoid Corporation,
Plaintiff-Appellee,
vs.
Minneapolis-Honeywell Regulator Company,
Defendant-Appellant.
} Appeal No. 8019.

The Mercoid Corporation,
Plaintiff-Appellant,
vs.
Minneapolis-Honeywell Regulator Company,
Defendant-Appellee.
} Appeal No. 8020.

STIPULATION.

It is hereby stipulated by and between the parties to the above entitled causes that the time within which The Mer-

coid Corporation may file a petition for rehearing be extended to and include January 17, 1943.

Bair & Freeman,
Attorneys for Minneapolis-Honeywell Regulator Company,
135 South La Salle Street,
December 28, 1942. Chicago, Illinois.

Langdon Moore,
Attorney for The Mercoid Corporation,
53 West Jackson Boulevard,
December 28, 1942. Chicago, Illinois.

Endorsed: Filed December 29, 1942. Kenneth J. Carrick, Clerk.

And on the same day, to-wit: On the twenty-ninth day of December, 1942, the following further proceedings were had and entered of record, to wit:

Tuesday, December 29, 1942.

Court met pursuant to adjournment.

Before:

Hon. William M. Sparks, Circuit Judge.

The Mercoid Corporation,
Plaintiff-Appellee,
8019 *vs.*
Minneapolis-Honeywell Regulator Co.,
Defendant-Appellant.

The Mercoid Corporation,
Plaintiff-Appellant,
8020 *vs.*
Minneapolis-Honeywell Regulator Co.,
Defendant-Appellee.

Appeals from the District Court of the United States for the Northern District of Illinois, Eastern Division.

Pursuant to stipulation of counsel, it is ordered that the time for The Mercoid Corporation to file a petition for rehearing of this cause be, and the same is hereby, extended to and including January 17, 1943.

And afterwards, to-wit: On the twelfth day of January, 1943, there was filed in the office of the Clerk of this Court, a Stipulation extending time to file rehearing, which said Stipulation is in the words and figures following, to-wit:

IN THE UNITED STATES CIRCUIT COURT OF APPEALS

For the Seventh Circuit.

The Mercoid Corporation,
Plaintiff-Appellee,
vs.
Minneapolis-Honeywell Regulator Company,
Defendant-Appellant.
} Appeal No. 8019.

The Mercoid Corporation,
Plaintiff-Appellant,
vs.
Minneapolis-Honeywell Regulator Company,
Defendant-Appellee.
} Appeal No. 8020.

STIPULATION.

It is hereby stipulated by and between the parties to the above entitled causes that the time within which The Mercoid Corporation may file a petition for rehearing be extended to and include January 23, 1943.

Bair & Freeman,
Attorneys for Minneapolis-Honeywell Regulator Company.
135 South LaSalle Street,
Chicago, Illinois.

January 11, 1943.

Langdon Moore,
Attorney for The Mercoid Corporation.
53 West Jackson Boulevard,
Chicago, Illinois.

January 11, 1943.

Endorsed: Filed January 12, 1943. Kenneth J. Carrick, Clerk.

And afterwards, to-wit: On the twelfth day of January, 1943, the following further proceedings were had and entered of record, to-wit:

Tuesday, January 12, 1943.

Court met pursuant to adjournment.

Before:

Hon. William M. Sparks, Circuit Judge.

The Mercoid Corporation,
Plaintiff-Appellee,
8019 *vs.*
Minneapolis-Honeywell Regulator Co.,
Defendant-Appellant.

The Mercoid Corporation,
Plaintiff-Appellant,
8020 *vs.*
Minneapolis-Honeywell Regulator Co.,
Defendant-Appellee.

Appeals from the District Court of the United States for the Northern District of Illinois, Eastern Division.

Pursuant to stipulation of counsel, it is ordered that the time for The Mercoid Corporation to file a petition for rehearing of this cause be, and the same is hereby, extended to and including January 23, 1943.

And afterwards, to-wit: On the twenty-third day of January, 1943, there was filed in the office of the Clerk of this Court, a Petition for a Rehearing, which said Petition for a Rehearing is not copied here.

And afterwards, to-wit: On the first day of February, 1943, there was filed in the office of the Clerk of this Court, an Answer to Petition for Rehearing, which said Answer is not copied here.

And afterwards, to-wit: On the twenty-seventh day of March, 1943, the following further proceedings were had and entered of record, to-wit:

Saturday, March 27, 1943.

Court met pursuant to adjournment.

Before:

Hon. William M. Sparks, Circuit Judge.
Hon. J. Earl Major, Circuit Judge.
Hon. Sherman Minton, Circuit Judge.

The Mercoid Corporation, *Plaintiff-Appellee,* 8019 *vs.* Minneapolis-Honeywell Regulator Co., *Defendant-Appellant.*	Appeals from the District Court of the United States for the Northern District of Illinois, Eastern Division.
The Mercoid Corporation, *Plaintiff-Appellant,* 8020 *vs.* Minneapolis-Honeywell Regulator Co., *Defendant-Appellee.*	

It is ordered by the Court that the petition for a hearing of this cause be, and it is hereby, denied.

And afterwards, to-wit: On the thirty-first day of March, 1943, there was filed in the office of the Clerk of this Court, Notice and Motion to Stay Mandate, which said Notice and Motion is in the words and figures following, to-wit:

In the United States Circuit Court of Appeals

For the Seventh Circuit.

The Mercoid Corporation, *Plaintiff-Appellee,* *vs.* Minneapolis-Honeywell Regulator Company, *Defendant-Appellant.*	Cause No. 8019.

The Mercoid Corporation, *Plaintiff-Appellant,* *vs.* Minneapolis-Honeywell Regulator Company, *Defendant-Appellee.*	Cause No. 8020.

NOTICE.

To: Bair & Freeman,
135 South LaSalle Street,
Chicago, Illinois.

Please Take Notice that I am this day filing with the Clerk of the Circuit Court of Appeals for the Seventh Circuit the attached Motion.

Langdon Moore,
L. Kerans Moore,
Attorneys for The Mercoid Corporation,
53 West Jackson Boulevard,
Chicago, Illinois.

Copy of the above Notice with Motion attached hereto received this 30th day of March, 1943.

(s) Bair & Freeman,
Attorneys for Minneapolis-Honeywell Regulator Company.

IN THE UNITED STATES CIRCUIT COURT OF APPEALS

For the Seventh Circuit.

The Mercoid Corporation,
Plaintiff-Appellee,
vs.
Minneapolis-Honeywell Regulator Company,
Defendant-Appellant.
Cause No. 8019.

The Mercoid Corporation,
Plaintiff-Appellant
vs.
Minneapolis-Honeywell Regulator Company,
Defendant-Appellee.
Cause No. 8020.

MOTION.

Now comes The Mercoid Corporation, plaintiff-appellee in Cause No. 8019 and plaintiff-appellant in Cause No. 8020, and moves this Honorable Court to stay the mandate in the above entitled causes for 30 days in order for The Mercoid Corporation to apply to the Supreme Court of the United States for a writ of certiorari to review the decision of this Court, petition for rehearing denied March 27, 1943.

The Mercoid Corporation.
By Langdon Moore,
L. Kerans Moore,
Its Attorneys.

Endorsed: Filed March 31, 1943. Kenneth J. Carrick, Clerk.

And afterwards, to-wit: On the first day of April, 1943, the following further proceedings were had and entered of record, to-wit:

Wednesday, April 1, 1943.

Court met pursuant to adjournment.

Before:

Hon. William M. Sparks, Circuit Judge.

The Mercoid Corporation, *Plaintiff-Appellee,* 8019 *vs.* Minneapolis-Honeywell Regulator Co., *Defendant-Appellant.*	Appeals from the District Court of the United States for the Northern District of Illinois, Eastern Division.
The Mercoid Corporation, *Plaintiff-Appellant,* 8020 *vs.* Minneapolis-Honeywell Regulator Co., *Defendant-Appellee.*	

On motion of counsel for The Mercoid Corporation, it is ordered that the issuance of the mandate in this cause be, and it is hereby, stayed pursuant to Rule 25 of the Rules of this Court.

UNITED STATES CIRCUIT COURT OF APPEALS

For the Seventh Circuit.

I, Kenneth J. Carrick, Clerk of the United States Circuit Court of Appeals for the Seventh Circuit, do hereby certify that the foregoing printed pages contain a true copy of the proceedings had and papers filed, excepting briefs of counsel, petition for rehearing and answer thereto, and stipulations and orders pertaining to briefs, in

The Mercoid Corporation,
Plaintiff-Appellee,
8019 *vs.*
Minneapolis-Honeywell Regulator Company,
Defendant-Appellant,

The Mercoid Corporation,
Plaintiff-Appellant,
8020 *vs.*
Minneapolis-Honeywell Regulator Company,
Defendant-Appellee,

as the same remains upon the files and records of the United States Circuit Court of Appeals for the Seventh Circuit.

In Testimony Whereof I hereunto subscribe my name and affix the seal of said United States Circuit Court of Appeals for the Seventh Circuit, at the City of Chicago, this 23rd day of April, A. D. 1943.

Kenneth J. Carrick,
(Seal) *Clerk of the United States Circuit Court of Appeals for the Seventh Circuit.*

SUPREME COURT OF THE UNITED STATES, OCTOBER TERM, 1943

No. 58

ORDER ALLOWING CERTIORARI—Filed June 7, 1943

The petition herein for a writ of certiorari to the United States Circuit Court of Appeals for the Seventh Circuit is granted, and the case is assigned for argument immediately following Nos. 973 and 974.

And it is further ordered that the duly certified copy of the transcript of the proceedings below which accompanied the petition shall be treated as though filed in response to such writ.

SUPREME COURT OF THE UNITED STATES, OCTOBER TERM, 1943

No. 59

ORDER ALLOWING CERTIORARI—Filed June 7, 1943

The petition herein for a writ of certiorari to the United States Circuit Court of Appeals for the Seventh Circuit is granted, and the case is assigned for argument immediately following Nos. 973, 974, and 994.

And it is further ordered that the duly certified copy of the transcript of the proceedings below which accompanied the petition shall be treated as though filed in response to such writ.